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Low-Level Radioactive Waste Disposal Facility

Statewide Mapping and Screening Protocol and Procedures

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Executive Summary

The Massachusetts Low-Level Radioactive Waste (LLRW) Management Board's (Board) *LLRW Management Plan* and *Siting Plan* identify the steps required in selecting a site for a low-level radioactive waste disposal facility in the Commonwealth. Statewide Mapping and Screening is the initial stage to identify and exclude from further consideration in the site selection process those areas of the Commonwealth that are obviously excluded by the criteria specified in the DEP site selection regulations. Initial Statewide Mapping and Screening will be performed using available digital data that can be applied at statewide map scales. The Statewide Mapping and Screening Protocol and Procedures identify the available digital data and describe how this data is to be applied at the Statewide Mapping and Screening stage.

Section 1 provides introductory material concerning the Statewide Mapping and Screening process, and the statutory framework and regulatory background for this screening stage.

Section 2 describes the exclusion criteria specified in the DEP site selection regulations. Some of the criteria can be applied at a statewide level while others are more suited for site-specific analysis. Available digital data are identified for each of these criteria including the source and any limitations of the database. Rationale is provided for the selection of criteria and databases to be included in the Statewide Mapping and Screening or to be deferred until later stages in the siting process.

Section 3 supplies the technical details for each of the existing digital databases that will be applied to map the exclusion criteria statewide. This section identifies which attributes of the database layers will be mapped for exclusion by the analysts conducting the Statewide Mapping and Screening.

Section 4 provides the specific procedures to be followed by the analysts conducting the Statewide Mapping and Screening. The final map products to be prepared are also identified in this section.

Section 5 describes the quality assurance program to be implemented during the conduct of Statewide Mapping and Screening. The purpose of this program is to ensure traceability of data and documentation of GIS mapping activities.

After the initial Statewide Mapping and Screening stage has been completed, the Board will initiate a volunteer siting program where landowners will be encouraged to offer potential sites in non-excluded areas for consideration, and communities will be invited to consider, through local referendum, the responsibilities and compensatory advantages of hosting a facility. The volunteer siting program will proceed for about two years, exclusive of any additional technical screening. Volunteer sites will continue to be encouraged and considered during the next two stages of technical screening. These stages, called Possible Locations and Candidate Site Identification, will apply the DEP siting criteria at more detailed scales to the non-excluded areas of the Commonwealth using additional data (not necessarily digital). Volunteered sites will be evaluated against the DEP siting criteria using the same criteria as are applied during these subsequent screening stages. The goal is to identify two to five potentially suitable candidate sites, some or all of which may have been volunteered. The candidate sites then will be evaluated in detail during a minimum one-year period of site-specific studies referred to as detailed site characterization. The Board will use the results of detailed site characterization to select one suitable site (referred to in the DEP regulations as the "superior" site) for a license application and development of an LLRW disposal facility.

TABLE OF CONTENTS

	Page
1. INTRODUCTION	**1**
1.1 Purpose	1
1.2 Background	1
1.3 Statewide Mapping and Screening Computer System	3
1.4 Legislative Framework	3
1.5 Regulatory Framework	3
2. DEP EXCLUSION CRITERIA	**4**
CMR 43.10 Modeling Capability	4
2.1 Modeling Capability	4
CMR 43.20 Groundwater Drinking Supplies and Resource Protection	6
2.2 Existing Public Water Systems - Zone III's	6
2.3 Existing Public Water Systems - Zone II's	7
2.4 Potentially Productive Aquifer	8
2.5 Existing Private Groundwater Sources	8
2.6 Potential Private Groundwater Sources	9
2.7 Sole Source Aquifers	10
2.8 Minimum Depth to Water Table	10
2.9 Depth to Bedrock	11
2.10 Horizontal Gradient	12
CMR: 43.21 Surface Water Drinking Supplies and Resource Protection	12
2.11 Class A Water Supplies	12
2.12 Class B Public Drinking Water Supplies	13
2.13 100 Year Flood Plain	14
2.14 Wetlands	14
2.15 Poor Draining Areas	16
2.16 Runoff Retention	16
2.17 Coastal High Hazard Zones	17
2.18 Dam Inundation Areas	17
2.19 Surface Water Discharges Onsite	18
CMR: 43.22 Tectonic Processes	19
2.20 Tectonic Processes	19
CMR: 43.23 Surface Geologic Processes	20
2.21 Surface Geologic Processes	20
2.22 Slope	20
CMR: 43.24 Demography	21
2.23 Demography: Effect on Facility Performance	21
2.24 Proximity to Sensitive Population Locations	22
CMR: 43.25 Site Size and Facility Compatibility	22
2.25 Department of Public Health Regulations (Site Size)	22
2.26 Management Board Determination (Site Size)	23
CMR: 43.26 Compliance with DPH Performance Criteria	23
2.27 Compliance with DPH Performance Criteria	23
CMR: 43.27 Meteorology and Climatology	24
CMR: 43.28 Transportation	24

TABLE OF CONTENTS (continued)

	Page
CMR: 43.29 General Land Use	24
2.28 Incompatible Activities	24
2.29 Interference with Monitoring	25
2.30 Agricultural Land	26
2.31 Acquisition Potential	26
CMR: 43.31 Protected Lands, Species and Resources	27
2.32 Areas of Critical Environmental Concern(ACEC)	27
2.33 Scenic Rivers and Streams	28
2.34 Federally Protected Resources	28
3. DETAILED DATA DESIGN FOR CRITERIA TO BE APPLIED DURING STATEWIDE SCREENING	**30**
3.1 Existing Public Water Systems (43.20:1b)	30
3.2 Sole Source Aquifer (43.20:1f)	31
3.3 Class A Water Supplies (43.21:1a)	31
3.4 Wetlands (43.21:1d)	32
3.5 Coastal High Hazard Zones (43.21:1g)	35
3.6 Dam Inundation Areas (43.21:1h)	36
3.7 Agricultural Land (43.29:1c)	36
3.8 Areas of Critical Environmental Concern (43.31:1a)	36
3.9 Scenic Rivers and Streams (43.31:1b)	37
3.10 Federally Protected Resources (43.31:1c)	38
4. PROCEDURES	**40**
4.1 General Procedures	40
4.2 Existing Public Water Systems	42
4.3 Sole Source Aquifer	43
4.4 Class A Water Supplies	43
4.5 Wetlands	43
4.6 Coastal High Hazard Zones	45
4.7 Dam Inundation Areas	46
4.8 Agricultural Land	46
4.9 Areas of Critical Environmental Concern	46
4.10 Scenic Rivers and Streams	47
4.11 Federally Protected Resources	47
4.12 Map Output	49
5. QUALITY ASSURANCE	**50**
5.1 Federal Regulatory Requirements	50
5.2 Massachusetts Regulatory Requirements	50
5.3 Statewide Mapping and Screening Quality Assurance Program	51
5.4 Quality Assurance Procedures for Statewide Mapping and Screening	53

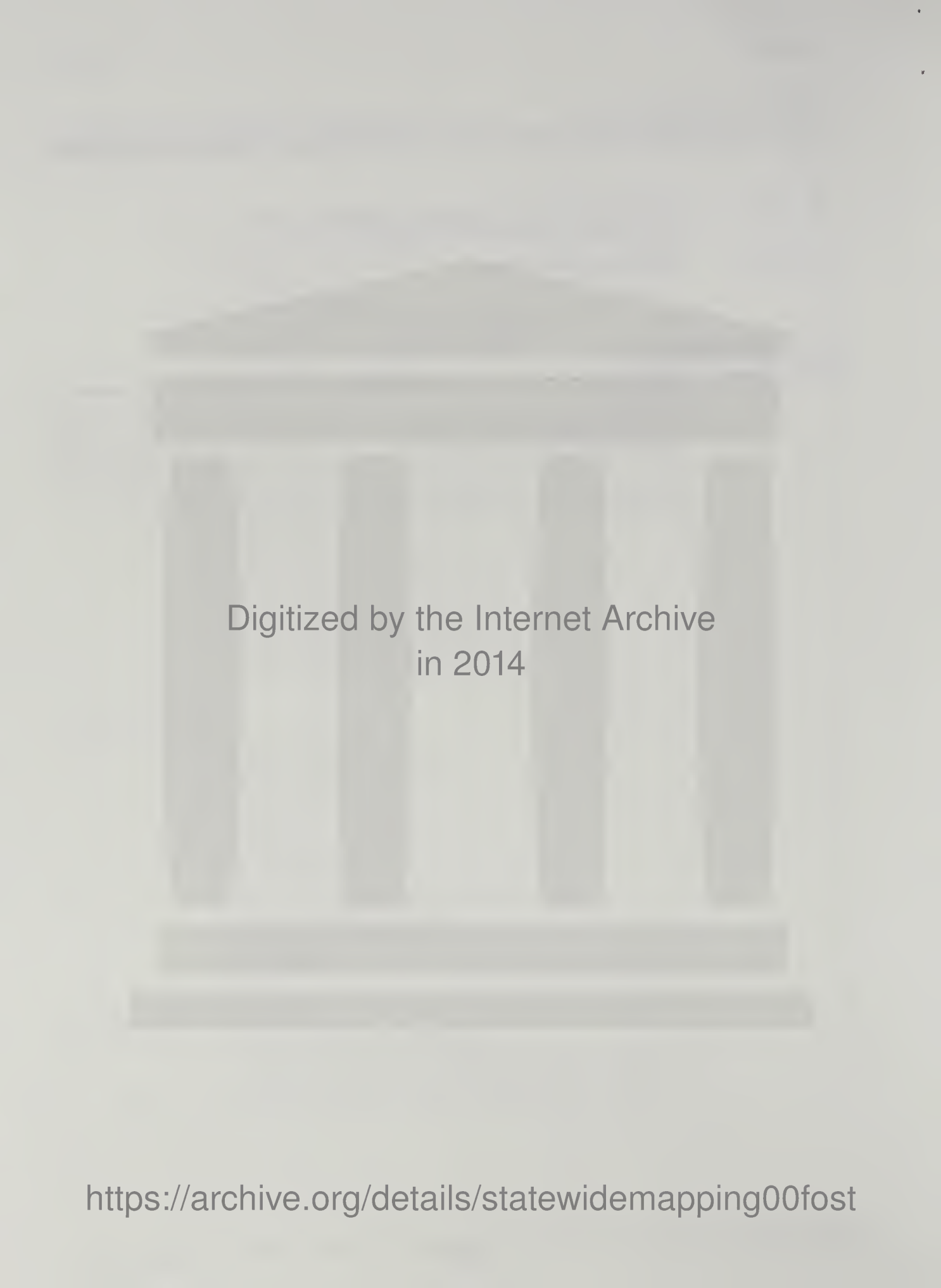
LIST OF APPENDICES

Appendix A **Site Selection Criteria for Low-Level Radioactive Waste Management Facilities (310 CMR 43.00)**

Appendix B **Quality Assurance Forms**

LIST OF EXHIBITS

	Page
Exhibit 1 Evaluation of Exclusion Criteria Summary	5
Exhibit 2 Summary of Databases to be Used for Identifying Exclusion Areas	42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1. INTRODUCTION

1.1 Purpose

This document identifies the available digital databases and describes how these databases are to be applied to map and exclude from further consideration in the site selection process those areas of the Commonwealth that are obviously excluded by the criteria specified in the Massachusetts Department of Environmental Protection (DEP) regulations (310 CMR 43.00): Site Selection Criteria for Low-Level Radioactive Waste (LLRW) Management Facilities.

1.2 Background

LLRW disposal facility[1] siting requirements are found in the Massachusetts Low-Level Radioactive Waste Management Act, M.G.L. c.111H (Chapter 111H), and in the policies and regulations adopted by the Management Board, the Massachusetts Department of Public Health (DPH) and DEP pursuant to those requirements. The Board's Siting Plan describes the approach for conducting the siting effort which includes a statewide technical screening program and a volunteer siting program.

Technical site selection consists of three basic stages as provided by Chapter 111H: Statewide Mapping and Screening, identification of Possible Locations that may contain one or more potential sites, and the selection of two to five Candidate Sites for detailed characterization. Additional criteria are applied at each successive stage. DEP regulations provide guidelines on how to apply certain criteria at each stage although the Board is given the authority to deviate from these guidelines. Any area that is excluded as part of one stage is removed from further consideration at a later stage.[2] This process is designed to eliminate areas that are likely to be unsuitable for a site and to narrow the field to a manageable number of candidate sites that can be evaluated in great detail. The screening process is intended to be a reasonable and cost effective approach.

It is recognized that some areas of the Commonwealth which are obviously unsuitable under the DEP siting criteria will not be mapped for exclusion during Statewide Mapping and Screening. This is due to practical limitations of conducting the screening at statewide map scales, to

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[1] Provisions of Massachusetts law cause "disposal" to be analogous to very, very long-term storage. These provisions include a prohibition on shallow land burial of LLRW; requirements for waste monitoring and retrieval, if necessary; and precluding the Commonwealth from abandoning a disposal facility as long as any LLRW contains activity above maximum concentrations allowed to be released under federal and state law.

[2] The intent of each stage of screening is to exclude from further consideration areas that appear not to meet the siting criteria. It should be noted, however, that in the situation that would require the Board to start the siting process anew, the potential exists that areas which were "excluded" once may not be excluded the second time around.

judgments concerning which exclusion criteria can be applied at this stage, and to using only data currently available in digital format. Statewide Mapping and Screening is only the first stage in the screening process, and **all** of the DEP siting criteria will be re-evaluated and applied during subsequent stages when suitable data are available for the smaller areas still being considered. Therefore, many areas that may appear obviously unsuitable from a local perspective, but are not excluded during the initial statewide screening, will be carefully evaluated and excluded as is appropriate during a future stage in the Board's siting process. Similarly, some small parcels of land may be excluded at this stage only because they cannot be adequately distinguished from areas that appear, at the statewide map scales, to contain exclusion characteristics.

Section 2 identifies currently available digital databases for each of the exclusion criteria. Some databases will not be used for the Statewide Mapping and Screening stage due to known inaccuracies in the data or if it is more appropriate to use the database at a later stage. MassGIS is the Commonwealth's computerized geographic information system operated through the Executive Office of Environmental Affairs. MassGIS contains a comprehensive compilation of data on numerous geologic, hydrologic, environmental, demographic, and infrastructure characteristics of the Commonwealth. Although MassGIS contains much of the digital data for conducting the Statewide Mapping and Screening, several additional sources were also considered at this stage, as listed below:

- United States Geologic Survey (USGS)
- U.S. Environmental Protection Agency (USEPA)
- Metropolitan District Commission (MDC)
- U.S. Fish and Wildlife Service (USF&W)
- National Heritage Endangered Species Program (NHESP)
- U.S. Census Bureau
- Massachusetts Historical Commission
- Weston Observatory of Boston College

The digital data has varying degrees of accuracy. At statewide map scales (1:100,000) this is generally not a problem, since even the width of a pen line at this scale is equivalent to about 100 feet on the ground. Because of the accuracy of the data, the location of boundary lines of excluded areas may vary by approximately +/- 250 feet at this scale. It is not recommended that the statewide exclusion maps be enlarged in order to apply the exclusion area boundaries at a much finer detail. A map is simply a picture representation of a physical feature and it is the actual feature that is subject to the exclusion criteria. During subsequent screening stages, the exclusion areas will be further delineated and refined using more accurate (or site-specific) data at a more detailed mapping scale.

1.3 Statewide Mapping and Screening Computer System

Statewide Mapping and Screening will be conducted at the Board's offices. This work will be performed using a Pentium class PC running Hummingbird X-Windows emulation software. This computer will be connected to the MassGIS Local Area Network (LAN). The GIS operator will log in to the MassGIS server over this network. The GIS software used will be ARC/INFO Version 7.0, which will be run on MassGIS' server. The X-Windows emulation software will enable the operator to run all ARC/INFO commands from the PC located in the Board's office. The operator will have access to the MassGIS database and will have a separate workspace for all Statewide Mapping and Screening work. Daily backups will be done using MassGIS' existing back-up software and hardware. All plots will be produced on MassGIS' plotters, located at the MassGIS office. Upon completion of the screening, the computer can be used to produce new maps based on future updates to the digital databases by MassGIS.

1.4 Legislative Framework

The Low-Level Radioactive Waste Policy Act of 1980 (Public Law 96-573) and the Low-Level Radioactive Waste Policy Amendments Act of 1985 (Public Law 99-240) require each state to manage LLRW generated within its borders either alone or, as part of a regional compact with one or more states. As a result of these federal mandates, ten multi-state compacts have been formed for this purpose. Five states, including Massachusetts, the District of Columbia, and Puerto Rico, are called unaffiliated (because they are not associated with any region) or "go-it-alone" players.

The overall process for development of an LLRW disposal facility in Massachusetts is outlined in M.G.L. Chapter 111H.

1.5 Regulatory Framework

The regulatory responsibility over an LLRW disposal facility is assigned to the U.S. Nuclear Regulatory Commission (NRC), unless transferred to a state under the Agreement State program. NRC regulations for the siting and licensing of an LLRW disposal facility are contained in Title 10 of the Code of Federal Regulations, Part 61 (10 CFR 61). NRC regulations pertaining to radiation exposure limits are included in Part 61, as well as in Part 20. In addition, NRC has published several guidance documents regarding the licensing process for such a facility.

Massachusetts has applied to NRC for authority to assume this responsibility, under the "Agreement State" program. Accordingly, the state has developed appropriate regulations to govern the control of radioactive materials and LLRW.

The principal state regulation governing site selection and Statewide Mapping and Screening is *Site Selection Criteria for Low-Level Radioactive Waste Management Facilities* (310 CMR 43.00), DEP regulations that establish the criteria and procedures to select sites for LLRW storage, treatment, and disposal facilities.

2. DEP EXCLUSION CRITERIA

LLRW disposal facility site selection criteria are found in the Code of Massachusetts Regulations 310 CMR 43.00 promulgated by DEP. A copy of these regulations is included in Appendix A (this regulation also defines many of the terms found in this document). The DEP regulations recognize that not all exclusion criteria can be applied at the Statewide Mapping and Screening stage. They provide "Application Guidelines" for the Statewide Mapping and Screening stage in 310 CMR 43.44. The Board and its contractor are generally observing these guidelines but may deviate from them where appropriate, as allowed by the DEP regulations. Data sets containing only partial coverage of the state will be used, as recommended by DEP, where the data is considered accurate enough to be applied statewide without significant likelihood of unnecessarily excluding suitable lands.

Only exclusion criteria are applicable to initial Statewide Mapping and Screening. Each of the DEP exclusion criteria are presented in this section along with any "Application Guidelines" provided by the DEP regulations and a description of any available digital databases which may be applicable for this screening. The rationale for whether to apply each exclusion criteria and what digital databases are appropriate for use at the Statewide Mapping and Screening stage are discussed in this section. A summary of this appears in Exhibit 1.

Some of the exclusion criteria are defined by DEP in terms of the entire LLRW site and some apply only to the smaller waste management area. It is possible for a suitable site to contain land or features excluded under certain criteria as long as the excluded feature is located outside the waste management area. For Statewide Mapping and Screening, it is not possible to differentiate between these two types of exclusions because the size of the site and waste management area have not been established. Therefore the composite statewide exclusion maps should be interpreted to apply only to the waste management area until more site-specific information is available.

CMR 43.10 Modeling Capability

2.1 Modeling Capability

2.1.1 Exclusion Criterion

"Exclude sites not capable of being adequately modeled, characterized, analyzed and monitored with respect to hydrogeology, geologic features and ground water flow characteristics as reasonably necessary to demonstrate compliance with DPH performance objectives and those provisions of applicable state and federal regulations governing environmental monitoring."

Exhibit 1 Evaluation of Exclusion Criteria Summary

Discussed in Section Number	Exclusion Criteria	Included in Statewide Screening
2.1	Modeling Capability	No
2.2	Existing Public Water Systems - Zone III's	No
2.3, 3.1, 4.2	Existing Public Water Systems - Zone II's	Yes
2.4	Potentially Productive Aquifer	No
2.5	Existing Private Groundwater Sources	No
2.6	Potential Private Groundwater Sources	No
2.7, 3.2, 4.3	Sole Source Aquifers	Yes
2.8	Minimum Depth to Water Table	No
2.9	Depth to Bedrock	No
2.10	Horizontal Gradient	No
2.11, 3.3, 4.4	Class A Water Supplies	Yes
2.12	Class B Public Drinking Water Supplies	No
2.13	100 Year Flood Plain	No
2.14, 3.4, 4.5	Wetlands	Yes
2.15	Poor Draining Areas	No
2.16	Runoff Retention	No
2.17, 3.5, 4.6	Coastal High Hazard Zones	Yes
2.18, 3.6, 4.7	Dam Inundation Areas	Yes
2.19	Surface Water Discharges Onsite	No
2.20	Tectonic Processes	No
2.21	Surface Geologic Processes	No
2.22	Slope	No
2.23	Demography: Effect on Facility Performance	No
2.24	Proximity to Sensitive Population Locations	No
2.25	Department of Public Health Regulations (Site Size)	No
2.26	Management Board Determination (Site Size)	No
2.27	Compliance with DPH Performance Criteria	No
2.28	Incompatible Activities	No
2.29	Interference with Monitoring	No
2.30, 3.7, 4.8	Agricultural Land	Yes
2.31	Acquisition Potential	No
2.32, 3.8, 4.9	Areas of Critical Environmental Concern	Yes
2.33, 3.9, 4.10	Scenic Rivers and Streams	Yes
2.34, 3.10, 4.11	Federally Protected Resources	Yes

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "Hydrogeologic units containing faults, deeply weathered bedrock, buried river channels and sand lenses if capable of delineation at this stage should be screened out."

2.1.2 Discussion of Criterion

The types of hydrogeologic units covered by this criterion include those containing faults, deeply weathered bedrock, buried river channels and sand lenses.

2.1.3 Description of Available Digital Data

There are no digital databases currently available that adequately describe the type of features excluded under this criterion. These characteristics are highly site specific and will need to be mapped at a later stage in site selection screening.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR 43.20 Groundwater Drinking Supplies and Resource Protection

2.2 Existing Public Water Systems - Zone III's

2.2.1 Exclusion Criterion

> "Existing Public Water Systems Pumping More Than 100,000 Gallons Per Day. Exclude sites located within the Zone III of an existing public water supply with a maximum approved pump rate of 100,000 gallons per day (gpd) or more."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "In determining the Zone III of the supply, the drainage sub-basin of the area in which the well is located shall be delineated and screened out."

2.2.2 Discussion of Criterion

A Zone III is that land area beyond a Zone II from which surface and ground water drain into the Zone II or area of contribution to the well. As such, it can be defined as the watershed, both surface and sub-surface, of the Zone II.

2.2.3 Description of Available Digital Data

Existing digital data includes Zone II delineations for both DEP approved Zone IIs and Interim Zone IIs. The approved Zone IIs are delineated based on hydrogeological investigations, while Interim Zone IIs are arbitrary half-mile buffers around the well. Watershed delineations at the

sub-basin level are also available. A Public Water Supplies datalayer also exists and contains attributes regarding type (groundwater, surface water, etc.) and yield.

Investigation of this existing GIS data indicates that the sub-basins are not defined in enough detail to accurately delineate the Zone III. Use of these sub-basins would, in many cases, result in over-excluding large areas of land. This is especially true when the well is located at the upper reaches of a sub-basin and would result in all of the down gradient portion of the basin being unnecessarily excluded. This criterion can be better applied at a later screening stage when the groundwater drainage areas can be accurately delineated using topographic base maps.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.3 Existing Public Water Systems - Zone II's

2.3.1 Exclusion Criterion

> "Existing Public Water Systems. Exclude sites located within the Zone II of an existing public water supply."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "In the absence of approved delineated Zone IIs, sites within the Interim Wellhead Protection Area (IWPA) of public water supplies shall be delineated and screened out."

2.3.2 Discussion of Criterion

A Zone II is defined in 310 CMR 22.02 as

> "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock."

Interim Wellhead Protection Areas (interim Zone IIs) are defined by a half-mile buffer around those wells not having an approved Zone II.

2.3.3 Description of Available Digital Data

Digital data exists for both approved and interim Zone II protection areas. Since the interim Zone IIs are defined by an arbitrary distance, they may either over-exclude or under-exclude the Zone IIs for some wells. However, the size of this area is not expected to be very significant at the scale of statewide screening.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.4 Potentially Productive Aquifer

2.4.1 Exclusion Criterion

> "Potential Productive Aquifer. Exclude sites located over a potential productive aquifer (PPA) which has been determined by the Department to be qualified for development as a public drinking water system prior to the issuance of the draft candidate site identification report pursuant to M.G.L. c. 111H, § 20(c). Notwithstanding this exclusion, a site may be located within a PPA qualified for development where the site is proposed to be located outside of the Zone II of any system and outside of the Zone III for systems pumping 100,000 gpd or more."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "The Board may choose to screen out sites located over potential productive aquifers without considering the likelihood that they will be determined to be qualified for development."

2.4.2 Discussion of Criterion

A Potentially Productive Aquifer is an aquifer that has been designated as high or medium yield. In addition, other factors such as local population density and land use affect whether or not an aquifer is classified as a PPA.

2.4.3 Description of Available Digital Data

DEP has identified and tagged all currently designated PPA's on the MassGIS aquifer coverages. However, since the DEP regulations provide certain conditions where a site may be located within a PPA, this criterion is better suited for analysis at a later stage in the screening process when site-specific data can be considered.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.5 Existing Private Groundwater Sources

2.5.1 Exclusion Criterion

> "Existing Private Ground Water Source Or Non-Community Water System. Exclude sites located within the Zone of Contribution of an existing private groundwater source or non-community system unless the source/system is located on the parcel of land that is designated to be acquired pursuant to M.G.L. c. 111H, § 23(g) and the source/system is secured from any use other than uses related to the construction, operation or environmental monitoring of the facility."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.5.2 Discussion of Criterion

A non-community water system is a public water system which is not a community water system, where a community water system is a public water system with at least 15 service connections or regularly serves at least 25 year-round residents. An example of a non-community water system would be the water supply for a restaurant or a factory.

2.5.3 Description of Available Digital Data

Cape Cod is the only area of the state for which private well data is available in digital format. This database includes only coordinates representing the point location of each well. There is no information regarding the Zone of Contribution of each well. Determination of this zone requires detailed information regarding the well characteristics such as depth, static water level, and yield, as well as hydrogeological information regarding the groundwater flow and permeability. Typically, the Zone of Contribution of a private well is quite small. As such, analysis of this exclusion criterion can be better achieved in a later stage of the screening process which will examine selected areas in more detail and can included field investigations.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.6 Potential Private Groundwater Sources

2.6.1 Exclusion Criterion

> "Potential Private Groundwater Source Or Non-Community Water System. Exclude sites located within the projected Zone of Contribution of a potential private groundwater source or non-community water system unless the source/system is located on the parcel of land to be acquired pursuant to M.G.L. c. 111H, § 23(g) and is secured from any use other than uses related to the construction, operation or environmental monitoring of the facility."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.6.2 Discussion of Criterion

This criterion is closely related to the one described in Section 2.5.2 except that potential future systems are to be considered.

2.6.3 Description of Available Digital Data

There is no data available at this time which adequately identifies these areas. Analysis of this exclusion criterion can be better achieved in a later phase of the siting study which will examine selected areas in more detail and can include field investigations.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.7 Sole Source Aquifers

2.7.1 Exclusion Criterion

> "Sole Source Aquifer. Exclude sites which are located over the areal extent of a sole source aquifer."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.7.2 Discussion of Criterion

A sole source aquifer is one that is designated by EPA as supplying 50% or more of the drinking water for the aquifer service area and for which there is no alternative source available should the aquifer become unusable.

2.7.3 Description of Available Digital Data

Five Sole Source Aquifers have been identified in Massachusetts by EPA. The extents of these aquifers have been digitized and are available within the MassGIS database.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.8 Minimum Depth to Water Table

2.8.1 Exclusion Criterion

> "Minimum Depth to Water Table. Exclude sites where the minimum depth to the water table is insufficient to prevent the intrusion of groundwater, perennial or otherwise, into the waste."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.8.2 Discussion of Criterion

While approximate depth to the water table can be inferred from such features as presence and frequency of wetlands, surface water bodies, and topography, an accurate determination typically

requires the drilling of monitoring wells and the examination of well logs. As such, this criterion is best considered at the site-specific level.

2.8.3 Description of Available Digital Data

There is no suitable digital data available statewide at this time.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.9 Depth to Bedrock

2.9.1 Exclusion Criterion

> "Minimum Depth And Overburden To Bedrock Water Table. Exclude sites where the water table is below the bedrock surface and where between the bedrock and the bottom of the waste management unit there is less than a minimum total thickness of ten feet of (unsaturated) soil units (natural or placed) with a maximum saturated hydraulic conductivity of 1x10(-4) cm/sec."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.9.2 Discussion of Criterion

This criterion seeks to minimize impacts on the bedrock water table. This is especially important in areas where there are private residential wells, since many of these are deep rock wells. This criterion also seeks to eliminate sites where the primary groundwater flow pathway from the waste management area to the site boundary is in bedrock and may be difficult to model and monitor.

2.9.3 Description of Available Digital Data

There is no existing digital data which would accurately identify these areas. The MassGIS Surficial Geology datalayer does provide statewide coverage showing some areas where bedrock outcrops at the ground surface. The water table is generally below the surface in these areas and so they would be excluded. However, the database was compiled at a map scale of 1:250,000 (1 inch = approximately 4 miles) and is very generalized compared to most other MassGIS data. Areas with outcropping bedrock are not clearly differentiated from areas where glacial till overlies bedrock to some thickness. Initial application of this criterion should be deferred until the next screening stage when more accurate geological maps (not presently available in digital format) can be used.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.10 Horizontal Gradient

2.10.1 Exclusion Criterion

> "Maximum Horizontal Gradient. Exclude sites where the average horizontal gradient in the uppermost aquifer underlying the site is more than 0.01."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.10.2 Discussion of Criterion

Identification of the horizontal gradient is best determined by the installation of monitoring wells both up and down gradient from a potential site. As such this criterion is not applicable to Statewide Mapping and Screening.

2.10.3 Description of Available Digital Data

There is no applicable digital data available at this time.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.21 Surface Water Drinking Supplies and Resource Protection

2.11 Class A Water Supplies

2.11.1 Exclusion Criterion

> "Class A Water Supplies. Exclude any site where the probable waste management area would be located within the watershed of a Class A public surface drinking water supply as defined in 314 CMR 4.05(3)(a)."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "In determining the watershed of an impounded surface water supply the drainage sub-basin of the supply shall be delineated and screened out."

2.11.2 Discussion of Criterion

Class A waters are designated as public water supplies and must meet certain criteria with regard to various water quality criteria such as dissolved oxygen and pH. The watershed is that area from which water falling on the ground surface will ultimately reach the water body.

2.11.3 Description of Available Digital Data

DEP has tagged and further delineated all watersheds of public surface water supplies in the state. Since the actual watersheds are delineated, drainage sub-basins need not be considered for this criterion. In addition, the watersheds of out-of-state public surface water supplies that extend into Massachusetts have also been tagged. An additional data set exists which delineates the "Cohen Act" lands, namely the watersheds and legislatively mandated protected areas of the Quabbin Reservoir, Ware River, and Wachusett Reservoir.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.12 Class B Public Drinking Water Supplies

2.12.1 Exclusion Criterion

> "Class B Public Drinking Water Supplies. Exclude any site where the probable waste management area will be located within any of the following areas of a Class B public surface drinking water supply as defined in 314 CMR 4.05(3)(b): 400 feet from the 100 year flood plain elevation extending 1/2 mile upgradient from the supply intake and extending 200 feet downgradient from the supply intake or to the physical spillway, whichever downgradient distance is less."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.12.2 Discussion of Criterion

The water quality criteria for a Class B waterbody is less stringent than for a Class A waterbody and correspondingly this exclusion criterion applies to a smaller area around the waterbody. Class B waters can be used for public water supplies with appropriate treatment.

2.12.3 Description of Available Digital Data

There is no available data set which directly corresponds to this exclusion criterion. Rather, a number of data sets would have to be used with manual delineation of the areas 400 feet from the 100-year floodplain half-mile up-gradient and 200 feet down-gradient. The statewide hydrography and public water supply data sets could be used to identify the water bodies. However, digital data for the 100-year floodplain is very limited and of poor accuracy (see Section 2.13). This criterion can be more effectively applied at a later screening stage when the extensive manual delineation required can be applied to smaller and more limited areas.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.13 100 Year Flood Plain

2.13.1 Exclusion Criterion

> "Flood Plain, 100 Year. Exclude any site in which the probable waste management area would be within any 100 year flood plain."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "The evaluation of flood plains should be determined by reference to the most recently available flood profile data prepared under the National Flood Insurance Program (NFIP), currently administered by the Federal Emergency Management Agency. The boundary, as determined, shall be presumed accurate. This presumption may be overcome only by reliable evidence from a registered professional engineer or other professional competent in such matters."

2.13.2 Discussion of Criterion

A flood of this magnitude can be expected to occur once every 100 years.

2.13.3 Description of Available Digital Data

Floodplain data in a digital format exists only for the Ware, Wachusett, and Quabbin watersheds. This data was digitized from the FEMA Flood Insurance Rate Maps (FIRM). These maps are at varying scales and have no coordinate reference points on them. Consequently, the digitizing was done by locating known points on the map and adjusting the digitized linework by an approximation technique known as "rubbersheeting". As a result, the accuracy of this data set is highly suspect. In addition, the areas for which this data exist will already be excluded under the Class A Water Supply criterion (see Section 2.11).

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.14 Wetlands

2.14.1 Exclusion Criterion

> "Wetlands. Exclude sites where the probable waste management area would be located within 100 feet of a resource area protected by the Wetlands Protection Act, M.G.L. c. 131, § 40 and 310 CMR 10.00."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.14.2 Discussion of Criterion

The Wetlands Protection Act covers 15 wetland-related resource areas including wetlands, both inland and coastal, and 100-year floodplains. This criterion applies to the waste management area, so it is permissible to have small wetlands within other portions of the site.

2.14.3 Description of Available Digital Data

There are several digital databases potentially applicable to this criterion, as follows:

- DEP is currently delineating wetlands at a 1:5000 scale under the Wetlands Conservancy Program, and data exists for portions of the state.
- U.S. Fish and Wildlife National Wetlands Inventory (NWI) maps are available in digital form for approximately 1/4 of the state. These maps can be used to map bordering vegetated wetlands as defined under the Wetlands Protection Act.
- Non-forested wetlands exist as a land use category in the statewide land use data layer.
- The Natural Heritage Endangered Species Program (NHESP) has delineated rare wetlands wildlife habitats.
- Water bodies are also protected under the Wetlands Protection Act, so the statewide hydrography data can be used.

Each of the above data sets will be used. The Wetlands Conservancy Program wetlands data offers the best accuracy, with the NWI data offering similar detail. The land use data set is somewhat limited in that only non-forested wetlands have been identified. All of these data sets were developed from interpretation of aerial photographs. Some of these wetland areas are very small and would add clutter and confusion at the scale of the statewide exclusion maps, especially since they are allowed to occur on portions of a site located outside the waste management area. The boundaries of the smaller wetlands may also not be as accurately identified from interpretation of aerial photographs. To minimize these problems, only wetlands greater than 50 acres in size will be mapped for statewide exclusion. Smaller wetlands will be mapped and excluded during the later stages of the screening process using data and base maps at more detailed scales. The statewide hydrography is appropriately accurate for application statewide, and all waterbodies included in that data set will be mapped, regardless of size.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.15 Poor Draining Areas

2.15.1 Exclusion Criterion

> "Poor Draining Areas. Exclude from the site any land that does not drain well and is subject to periodic flooding or frequent ponding."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.15.2 Discussion of Criterion

Poor draining areas not already excluded as wetlands (refer to Section 2.14) are generally localized and can best be identified using detailed site-specific soil data and field observations, making this criterion not applicable on a statewide basis.

2.15.3 Description of Available Digital Data

Other than the wetlands data described in Section 2.14, no GIS data currently exists which accurately delineates poor draining areas.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.16 Runoff Retention

2.16.1 Exclusion Criterion

> "Runoff Retention. Exclude from the site upland drainage areas which, due to their size, geometry, and surface characteristics, are unable by natural drainage patterns and normal engineering drainage controls to reliably channel the surface runoff expected from a statistical 100-year precipitation event without significantly eroding or inundating the probable waste management area."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.16.2 Discussion of Criterion

Delineation of these areas requires information on topography, soils, and geology that is accurate at a site-specific scale. This criterion applies only to the waste management area, so it is possible to have other portions of the site within these drainage areas.

2.16.3 Description of Available Digital Data

There is no digital data available for this criterion.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.17 Coastal High Hazard Zones

2.17.1 Exclusion Criterion

"Coastal High Hazard Zones. Exclude sites in coastal high hazard zones."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "In determining the coastal high hazard zones the coastal areas within the 100 year flood plain as delineated in the most recently available profile data prepared under the NFIP and all barrier beaches should be delineated and screened out."

2.17.2 Discussion of Criterion

Coastal high hazard zones are areas identified by the Office of Coastal Zone Management which are subject to inundation caused by 100-year coastal storms or the storm-of-record. They typically include coastal beaches, coastal dunes, barrier beaches, and other low-lying coastal features.

2.17.3 Description of Available Digital Data

These areas have been mapped and exist as a data layer in the MassGIS database.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.18 Dam Inundation Areas

2.18.1 Exclusion Criterion

"Dams. Exclude sites in areas subject to inundation by the failure of an existing dam."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "Sites located in an area which would be affected by the failure of a dam with a Hazard Classification Class I or Class II, as determined in accordance with 302 CMR 10.09(3), which are capable of delineation at this stage should be screened out. The downstream inundation flood zone may be determined on the basis of records maintained by the Dam Safety Division of the Department of Environmental Management."

2.18.2 Discussion of Criterion

Dams are classified by 302 CMR 10.09(3) by hazard potential with Class I dams having a high hazard potential, Class II dams having a significant hazard potential and Class III dams having a low hazard potential. Class I dams are defined as dams located where failure *will likely* cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s). Class II dams are defined as dams located where failure *may* cause loss of life and serious damage to home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.

2.18.3 Description of Available Digital Data

The Dam Safety Division of the Department of Environmental Management maintains a digital database of all dams in the state. However, this data includes only the location coordinates for each dam and not the areas subject to inundation. Inundation studies have been done for dams at the Quabbin Reservoir and the Sudbury/Framingham Reservoirs. GIS data exists for each of these inundation areas.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.19 Surface Water Discharges Onsite

2.19.1 Exclusion Criterion

> "Surface Water Discharges. Exclude sites in which a hydrogeologic unit within the probable waste management area discharges groundwater to the surface within the site."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.19.2 Discussion of Criterion

This is a site-specific criterion which requires site investigation and detailed information about the local hydrogeology. As such it is not applicable to statewide exclusion screening.

2.19.3 Description of Available Digital Data

There is no digital data available for this criterion.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.22 Tectonic Processes

2.20 Tectonic Processes

2.20.1 Exclusion Criterion

> "Tectonic Processes. Exclude sites where tectonic processes in the vicinity, such as faulting, folding, seismic activity, or volcanism are reasonably likely to adversely affect the ability of the probable waste management area to meet DPH performance objectives or preclude adequate modeling and prediction of long-term impacts."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.20.2 Discussion of Criterion

There is no evidence for currently active tectonic processes anywhere in the Commonwealth of a magnitude that would adversely affect the ability of a properly designed disposal facility to meet DPH performance objectives. No active volcanism or surface faulting or folding has been identified anywhere in the area. Small to moderate earthquakes do occur infrequently, and a few damaging earthquakes have been reported during the last 475 years of recorded history. The damaging earthquakes occurred in the 1700s and are not very accurately located. The largest is thought to have occurred off-shore from Cape Ann in 1755.

Geologically ancient faulting and folding has affected the bedrock underlying all of the Commonwealth to some degree. These features may affect the local hydrogeologic flow system, and increase the complexity and uncertainty associated with modeling the performance of any potential site. However, the importance of this potential adverse impact cannot be adequately determined without access to site-specific subsurface data (soil type and thickness, depth to watertable, etc.) which are not available at a scale or accuracy suitable for statewide exclusion screening.

2.20.3 Description of Available Digital Data

The U.S. Geological Survey and the Weston Observatory of Boston College maintain digital earthquake catalogs that include the size and location (estimated or measured) of earthquakes known to have occurred in the Commonwealth in historic times. A statewide bedrock geology map has also been compiled at a scale of 1:250,000, but faults and other ancient tectonic features shown are generalized from more detailed paper maps, most of which were originally prepared at a scale of 1:24,000 or less and will be applicable to later stages in the screening process. As was discussed above, none of the available tectonic data is thought to provide a suitable basis for excluding any areas during statewide screening.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.23 Surface Geologic Processes

2.21 Surface Geologic Processes

2.21.1 Exclusion Criterion

> "Surface Geologic Process. Exclude sites where the probable waste management area would be located in the vicinity of surface geologic processes such as mass wasting, erosion, slumping, landsliding, which occur with such frequency and extent that such events would be reasonably likely to adversely affect the ability of the site to meet any DPH performance objectives or preclude adequate modeling and prediction of long term impacts."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.21.2 Discussion of Criterion

This criterion deals with local characteristics, specific to the potential waste management area, that require more in-depth site specific analysis than can be accomplished on a statewide level.

2.21.3 Description of Available Digital Data

Maps showing landslide areas and related processes are available from the USGS and in published geologic literature. However, these are not currently available in digital format.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.22 Slope

2.22.1 Exclusion Criterion

> "Exclude sites where the probable waste management area would have an average slope greater than 20 percent."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.22.2 Discussion of Criterion

This criterion deals with local slope conditions, specific to the potential waste management area, that can be more accurately and cost-effectively analyzed at a later screening stage.

2.22.3 Description of Available Digital Data

Slope information can be determined from Digital Elevation Models (DEMs), however, this data is only available statewide at a scale of 1:250,000 and is judged to be of insufficient accuracy. The guidance for this criterion outlined in CMR 43.61(16) indicates that USGS 1:25,000 quadrangles should be used. Some 1:25,000 DEM or contour data (from which a DEM could be derived) is currently available; however even at this scale, the digital DEM data may be insufficient to accurately delineate slopes over relatively small areas.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.24 Demography

2.23 Demography: Effect on Facility Performance

2.23.1 Exclusion Criterion

> "Effect On Facility Performance. Exclude sites where the existing population density, projected population growth or future development in the vicinity of the site is reasonably likely to interfere with the ability of the facility to meet DPH performance objectives."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.23.2 Discussion of Criterion

This criteria seeks to minimize exposure to the surrounding population. The guidance for this criteria outlined in CMR 43.61(16) indicates that a five mile radius of the site should be examined with future impacts examined through the life of the facility. Items that would be examined include existing land use, zoning, and development plans. While this criteria applies to the entire site, the collection of such data requires a more detailed picture of what the design of the facility might be in order to determine both the physical layout of the site and how the DPH performance objectives would apply.

2.23.3 Description of Available Digital Data

Data from the 1990 census exists statewide, while current land use (1990) exists for the eastern half of the state. However, the additional data required, such as zoning and future development plans, do not.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.24 Proximity to Sensitive Population Locations

2.24.1 Exclusion Criterion

"Proximity To Sensitive Population Locations. Exclude sites where the probable waste management area would be located in proximity to sensitive population locations as a result of which:

1. It is reasonably likely that the site will not be able to meet the DPH performance objectives; or

2. The exposure to radiation or toxic materials, if mixed waste is to be accepted at the site, which a member of the affected sensitive population is reasonably likely to receive in the event of a release of radiation or hazardous waste from the site would result in a significantly higher than normal risk of adverse effect on the health of the sensitive population."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.24.2 Discussion of Criterion

This criterion is closely related to the demography criterion described in Section 2.23.

2.24.3 Description of Available Digital Data

No digital data currently exists which specifically identifies sensitive populations.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.25 Site Size and Facility Compatibility

2.25 Department of Public Health Regulations (Site Size)

2.25.1 Exclusion Criterion

"DPH Regulations. Exclude sites that are insufficient in size to contain a waste management area, a buffer zone and other facility components."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.25.2 Discussion of Criterion

This criterion excludes those areas that have not been excluded based on other criteria, but are of insufficient size to encompass the entire site. The minimum site size needed to satisfy DPH

regulations is a site-specific issue that requires on-site testing and performance analyses that cannot be accomplished at the statewide screening stage.

2.25.3 Description of Available Digital Data

There is no digital data available for this criterion.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.26 Management Board Determination (Site Size)

2.26.1 Exclusion Criterion

> "Management Board Determination. Exclude sites that are insufficient in size to meet the minimum land areas determined by the Board to be required for suitable facilities."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.26.2 Discussion of Criterion

This criterion is intended to provide an initial estimate of minimum site size to be used for screening purposes until site specific size requirements are determined to meet DPH regulations.

2.26.3 Description of Available Digital Data

This criterion can be applied using GIS programming without additional data once the Board has determined the minimum size for the disposal facility.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.26 Compliance with DPH Performance Criteria

2.27 Compliance with DPH Performance Criteria

2.27.1 Exclusion Criterion

> "Exclude sites which are not reasonably likely to meet DPH performance objectives based on a performance assessment that, at a minimum, incorporates the facility design standards of probable suitable technologies set forth at 105 CMR 120.815."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.27.2 Discussion of Criterion

This criterion requires design information for the facility and site specific data in order to carry out a performance assessment. The necessary information will not be available until the detailed site characterization siting stage is completed.

2.27.3 Description of Available Digital Data

There is no digital data available for this criterion.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.27 Meteorology and Climatology

There are no exclusion criteria for this category in the DEP regulations.

CMR: 43.28 Transportation

There are no exclusion criteria for this category in the DEP regulations.

CMR: 43.29 General Land Use

2.28 Incompatible Activities

2.28.1 Exclusion Criterion

> "Incompatible Nearby Activities. Exclude sites where the probable location of the waste management area in relation to nearby activities is reasonably likely to adversely affect the ability of the site to meet DPH performance objectives."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.28.2 Discussion of Criterion

This criterion requires site specific information and will be analyzed in detail during later stages in the screening process. It is partially addressed by the demography criterion as described in Section 2.23.

2.28.3 Discussion of Available Digital Data

There is no available digital data which specifically delineate incompatible activities.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.29 Interference with Monitoring

2.29.1 Exclusion Criterion

> "Interference With Monitoring. Exclude sites where the probable location of the waste management area in relation to nearby past or present activities is reasonably likely to significantly impair the environmental monitoring program including, without limitation, existing or past activities or natural sources that emit radioactivity or release non-radioactive material into the environment to the extent that it is reasonably likely to adversely affect the ability of the environmental monitoring program to detect or monitor the existence or magnitude of emissions or releases from the facility or the site."

DEP provides the following guideline for applying this criterion at the Statewide Mapping and Screening stage:

> "Places where National Priority List sites, Resource Conservation and Recovery Act facilities, any locations of releases or sites as defined pursuant to M.G.L. c. 21E and regulations promulgated thereunder, any solid waste disposal sites as defined pursuant to M.G.L. c. 111, § 150A and the regulations promulgated thereunder or Leaking Underground Storage Tanks as defined in M.G.L. c. 148 § 38B are identified and that are capable of delineation at this stage should be evaluated if there is reason to believe radioactive materials or mixed waste were used or disposed of at those locations. The Board may choose to defer elimination of an area described herein on the basis of further data on the extent to which existing potential contamination of the site will affect the performance of the site and its ability to be adequately monitored."

2.29.2 Discussion of Criterion

This criterion is intended to identify and evaluate these sites and not necessarily to exclude them. This evaluation is more appropriate for application at a later stage of the screening process when site-specific data can be considered.

2.29.3 Description of Available Digital Data

A number of digital data sets exist at the federal and state level which have the geographic locations of NPL, RCRA and solid waste disposal sites. DEP also has locations of underground storage tanks. However, some of this data is of questionable locational accuracy and is lacking specifics as whether radioactive or mixed waste was used or disposed of at these locations. More site-specific investigations or surveys of historical data would be required to characterize the types of contamination present. Therefore, it cannot be determined at this point how these sites might impact LLRW facility performance or monitoring.

This criterion will not be applied at the Statewide Mapping and Screening stage.

2.30 Agricultural Land

2.30.1 Exclusion Criterion

> "Agricultural Land. Exclude sites located on prime agricultural land based on soil classification established by the U.S. Soil Conservation Services or on land designated as an agricultural incentive area pursuant to M.G.L. c. 40L, § 1 *et seq.* on or before December 31, 1992."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.30.2 Discussion of Criterion

This criterion excludes areas that are have soils designated as prime agricultural land by the Natural Resources Conservation Service or are designated agricultural incentive areas under Massachusetts statute.

2.30.3 Description of Available Digital Data

Soil surveys exist in paper form for the entire state. MassGIS is currently digitizing these maps starting with the Connecticut River Valley. There is no currently available digital data which identifies agricultural incentive areas. The digitized NRCS soils data that is available at the time statewide screening is performed (summer 1996) will be used.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.31 Acquisition Potential

2.31.1 Exclusion Criterion

> "Acquisition Potential. Exclude sites to which the Commonwealth cannot obtain title."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.31.2 Discussion of Criterion

With the possible exception of federally owned lands, the Commonwealth can obtain title through eminent domain for essentially any piece of land in the state. In reality, there are areas for which acquisition by eminent domain would be very difficult and are unlikely to be undertaken by the Commonwealth. The intent of this criterion is to exclude such areas. Areas under federal, municipal, or private non-profit ownership or which have specific deed restrictions such as agricultural or aquifer protection may be considered as areas to which the Commonwealth cannot obtain title.

2.31.3 Description of Available Digital Data

The Protected Open Space coverage contains information regarding ownership, level of protection, restrictions, and funding sources. This data is not uniform statewide and is in an ongoing revision process. Since federal protected lands will be separately excluded under CMR 43.31, only land under private non-profit ownership as identified in the Protected Open Space data set could possibly be evaluated statewide under this criterion. State and municipal owned open space also has some level of protection that may make it difficult for the Commonwealth to obtain title. The locally protected lands and private non-profit ownership lands are best evaluated on a parcel-by-parcel basis due to the small size of many of these parcels and the incomplete information in existing databases as to their use and actual ownership. Furthermore, municipally owned land should not be excluded at this time because it would preclude the ability of a town to volunteer such land if it so chose.

This criterion will not be applied at the Statewide Mapping and Screening stage.

CMR: 43.31 Protected Lands, Species and Resources

2.32 Areas of Critical Environmental Concern(ACEC)

2.32.1 Exclusion Criterion

> "Areas Of Critical Environmental Concern. Exclude sites located in any area of critical environmental concern designated pursuant to M.G.L. c. 21A, § 2(7), St. 1974, c. 808, § 401(e) and 301 CMR 11.15." [Note: DEP regulations contain an inaccurate citation. Should be C.806, § 40(e) of the Acts of 1974, not Chapter 808, § 401(e). The correct CMR is 301 CMR 12.00, not 301 CMR 11.15.]

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.32.2 Discussion of Criterion

An ACEC is defined in 301 CMR 12 as:

> ...those areas within the Commonwealth where unique clusters of natural and human resource values exist and which are worthy of a high level of concern and protection.

2.32.3 Description of Available Digital Data

The ACEC data layer in the MassGIS database shows the locations of all designated ACECs.

This criterion will be applied at the Statewide Mapping and Screening stage.

2.33 Scenic Rivers and Streams

2.33.1 Exclusion Criterion

> "Scenic Rivers And Streams. Exclude sites located in scenic and recreational rivers and streams of the Commonwealth designated pursuant to 302 CMR 3.00."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.33.2 Discussion of Criterion

A designated scenic river or stream is one for which a state protective order, management plan or the equivalent has been adopted. It includes a river corridor of 300 feet on each side of the designated stream. There currently exist two such rivers in the state:

- North River, Hanover to Scituate, with parts of the Indian Head River and Herring Brook in Pembroke, with a total length of 18.2 miles; and,
- Money and Hopper Brooks in Williamstown, with a total length of 6.1 miles.

Other rivers and streams are classified as Scenic, but are not yet designated by the Commonwealth and are thus not excluded under this criterion. There also exist a number of local scenic rivers which are designated and protected by the local community. These too are not excluded under this criterion.

2.33.3 Description of Available Digital Data

The Hydrography data layer contains all rivers in the Commonwealth. The designated scenic rivers will be identified on this datalayer and a 300-foot buffer created on either side of them, thus delineating the exclusion area. Note that the actual watercourses of all rivers and streams will be excluded as discussed in Section 2.14 (wetlands).

This criterion will be applied at the Statewide Mapping and Screening stage.

2.34 Federally Protected Resources

2.34.1 Exclusion Criterion

> "Federally Protected Resources. Exclude sites that are reasonably likely to adversely affect any national park, monument, lake shore, habitat of endangered species, or area protected by the Wilderness Act, 16 USC §§ 1131-1136, the Wild and Scenic Rivers Act, 16 USC §§ 1771-1287, and the Fish and Wildlife Coordination Act, USC §§ 661-666c; or the National Historic Preservation Act, 16 USC §§ 470-470m."

DEP provides no guideline for applying this criterion at the Statewide Mapping and Screening stage.

2.34.2 Discussion of Criterion

There are a number of national parks in the state as well as Federally recognized historic districts. A segment of the Westfield River in Western Massachusetts has recently be designated a Wild and Scenic River. There are no Federal Wilderness areas.

2.34.3 Description of Available Digital Data

The Protected and Recreational Open Space data layer identifies all protected federal lands. Federally recognized historic districts have been digitized by the Massachusetts Historical Commission. The section of the Westfield River that is a Wild and Scenic River will be delineated in the same manner as Designated Scenic Rivers outlined in Section 2.33. All these data sets will be used to prepare exclusion maps statewide.

Endangered species habitats have been delineated by the Natural Heritage and Endangered Species Program. However, these areas are purposely large and not exact. This database is more suited to analysis at a later screening stage when site-specific data can be considered.

This criterion will be applied at the Statewide Mapping and Screening stage.

3. DETAILED DATA DESIGN FOR CRITERIA TO BE APPLIED DURING STATEWIDE SCREENING

Section 2 identified the criteria to be included in the Statewide Mapping and Screening. This section identifies and describes the specific digital databases and identifies the technical attributes that will be used. The applicable CMR reference is provided in parenthesis at the end of the section title for each exclusion criterion.

Each digital database can contain a number of technical attributes. This section lists only those attributes which will be used to prepare maps for Statewide Mapping and Screening. Each attribute may have several codes. With the exception of the hydrography data set all codes have been listed, including those that will not be used. The discussion for each exclusion criterion identifies which codes are to be included in the screening and explains why certain codes will not be used.

3.1 Existing Public Water Systems (43.20:1b)

3.1.1 Database Description

Two data sets define this exclusion criterion, the ZONE_IIS data set and the IWPA data set. These data sets contain the DEP approved Zone II boundaries and the interim Zone II areas, respectively. The latter include half-mile buffers around those wells that do not have an approved Zone II.

The approved Zone II boundaries were generated from technical reports produced under various Water Supply Division programs, usually by private consultants. Once these reports were approved, the Zone II boundary was transferred to the Water Sources overlay of the Water Supply Protection Atlas. The boundaries were then digitized from the DEP Water Supply Protection Atlas at 1:25,000 scale.

The interim Zone II coverage consists of circles with a half-mile radius around all public water supply wells that do not have an approved Zone II delineation. These were created by selecting all sources from the Community Public Water Supplies data layer which were groundwater sources and for which an approved Zone-II had not been delineated. These sources were then buffered using a half-mile radius.

The following polygon attributes are associated with these data layers:

Zone II

ZONE_IIS-ID	The unique identifier for each polygon
AREA-ACRES	The area, in acres, of each polygon
ZII-DEF	Type of Zone II: 1 = Actual (Approved) Zone II

2 = Interim Wellhead Protection Area
3 = Surface Water Body

IWPA

No attributes

3.1.2 Exclusion Method

All areas within either of these data sets will be mapped for exclusion.

3.2 Sole Source Aquifer (43.20:1f)

3.2.1 Database Description

EPA has identified five Sole Source Aquifers in Massachusetts. This data set is named SSA and was compiled by the DEP Division of Water Supply from data supplied by EPA in both digital and non-digital formats. Once this data was compiled into a statewide coverage, it was submitted to EPA for verification.

The polygon attributes for this coverage are:

SSA_NUM	The unique id for each Sole Source Aquifer
SSA_NAME	The name of the Sole Source Aquifer

3.2.2 Exclusion Method

All areas contained in this database will be mapped for exclusion.

3.3 Class A Water Supplies (43.21:1a)

3.3.1 Database Description

A statewide data set of approximately 1,880 sub-basins has been produced by MassGIS. These basins were originally delineated on 1:24,000 USGS quadrangles by the USGS Water Resources Division. The basins were delineated using the contours and hydrography on the individual quads as the primary guide. Many basins have their mouth at a stream gauging station, rather than the true hydrological mouth. This data set is tiled into four panels - WEST, MID, EAST, and SE - based on major river basin divides. This data layer is named SUB-<panel>.

DEP has delineated additional basins based on the intake points of public water supplies. All upstream basins were coded to indicate whether they contribute to a surface public water supply and the type of supply.

The polygon attributes for this data layer are as follows:

WSP	Public Surface Water Supply Basin codes
1	Surface Water Supply Watershed
2	Emergency/Backup Surface Water Supply Watershed
3	Adjacent State Surface Water Supply Watershed
4	MDC/MWRA Watershed

3.3.2 Exclusion Method

All polygons where WSP includes: Surface Water Supply Watershed (WSP = 1); Adjacent State Surface Water Supply Watershed (WSP = 3); and, MDC/MWRA Watershed (WSP = 4); will be mapped for exclusion. Those areas coded as Emergency/Backup Surface Water Supply Watersheds (WSP = 2) are not included since none of these areas are Class A waterbodies.

3.4 Wetlands (43.21:1d)

3.4.1 Database Description

Five separate data sets will be used for this criterion. Four of these are developed and maintained by MassGIS and one by the U.S. Fish and Wildlife Service.

3.4.1.1 Hydrography

The statewide hydrography data set will be used to identify all waterbodies. This data set contains all the water features in the state based on the USGS 1:100,000 scale Digital Line Graphs which have been enhanced by checking the data against 1:25,000 scale quadrangles. This data is tiled by 7.5 minute 1:25000 quadrangle.

The polygon attributes for this data include:

MINOR_TOT	Concatenated feature code from USGS DLG major/minor pairs.
SOURCE	Data Source ENH = 1:100,000 enhanced DLG = 1:25,000 USGS DLG DIG = 1:25,000 Digitized Quads
MINOR_NUM	Same as MINOR_TOT

The MINOR_TOT and MINOR_NUM attributes are the major/minor codes from the original USGS Digital Line Graph (DLG) files. These numeric code pairs represent different types of waterbodies such as reservoirs, lake or pond, or stream. There are 97 possible codings, though not all of the tiles contain all of them.

3.4.1.2 Wetlands Conservancy Program

This is an ongoing project begun in 1990 to map wetlands using 1:12,000 scale color infrared photography. Wetland areas are delineated at the Wetlands Mapping Unit at the University of Massachusetts at Amherst. The wetlands areas are broken down into 28 categories. The minimum mapped area is 1/4 acres. Partial coverage exists for the state at this time.

In this database, wetlands are coded by type as shown below.

WETCODE	Description
1	COASTAL BANK BLUFF OR SEA CLIFF
2	BARRIER BEACH SYSTEM
3	COASTAL BEACH
4	BOG
5	CRANBERRY BOG
6	COASTAL DUNE
7	DEEP MARSH
8	SHALLOW MARSH MEADOW OR FEN
9	OPEN WATER
10	ROCKY INTERTIDAL SHORE
11	SALT MARSH
12	SHRUB SWAMP
13	TIDAL FLAT
14	WOODED SWAMP DECIDUOUS
15	WOODED SWAMP CONIFEROUS
16	WOODED SWAMP MIXED TREES
17	BARRIER BEACH-COASTAL BEACH
18	BARRIER BEACH-BOG
19	BARRIER BEACH-COASTAL DUNE
20	BARRIER BEACH-DEEP MARSH
21	BARRIER BEACH-MARSH
22	BARRIER BEACH-OPEN MARSH
23	BARRIER BEACH-SHRUB SWAMP
24	BARRIER BEACH-WOODED SWAMP DECIDUOUS
25	BARRIER BEACH-WOODED SWAMP CONIFEROUS
26	BARRIER BEACH-WOODED SWAMP MIXED TREES
88	N/A
99	UPLAND

3.4.1.3 Land Use

This is a statewide data set of land use developed from color infrared aerial photographs. The photography was acquired in 1985 and was photointerpreted by the Resource Mapping Project at the University of Massachusetts at Amherst. A total of 21 land use categories were identified, with Cape Cod and Southeastern Massachusetts having some additional categories added. This data set is tiled by town, with a total of 351 tiles named LU-<town number>.

The 21 land use categories included in the land use data set are:

LU21_CODE	Description
1	CROP LAND (AC)
2	PASTURE (AP)
3	FORESTLAND (F)
4	INLAND WETLAND (FW)
5	MINING (M)
6	OPEN LAND (O)
7	PARTICIPATION RECREATION (RP)
8	SPECTATOR RECREATION (RS)
9	WATER BASED RECREATION (RW)
10	MULTI-FAMILY RESIDENTIAL (RO)
11	HIGH DENSITY RESIDENTIAL (R1)
12	MED. DENSITY RESIDENTIAL (R2)
13	LOW DENSITY RESIDENTIAL (R3)
14	SALT MARSH (SW)
15	COMMERCIAL (UC)
16	INDUSTRIAL (UI)
17	URBAN OPEN -OR- PUBLIC (UO)
18	TRANSPORTATION (UT)
19	WASTE DISPOSAL (UW)
20	WATER (W)
21	WOODY PERENNIAL - ORCHARD (WP)

3.4.1.4 Estimated Habitats of State-Listed Rare Wetlands Wildlife

This data layer consists of a statewide coverage of the estimated habitats of state-listed rare wetlands wildlife populations. These habitats are based on records in the Natural Heritage and Endangered Species Program's Biological and Conservation Data System database. These areas were compiled onto 1:25,000 scale USGS quadrangles and digitized. These habitats are delineated in accordance with the Wetlands Protection Act. This is a statewide coverage named WETHAB95.

There are no attributes associated with this data layer other than the standard default ARC/INFO polygon attributes for internal-id, user-id, perimeter, and area.

3.4.1.5 National Wetlands Inventory(NWI) Maps

The United States Fish and Wildlife Service is in the process of digitizing all available NWI maps for the country. Approximately 1/4 to 1/3 of Massachusetts has been completed. NWI maps are photointerpreted from aerial photography according to standards outlined in *Classification of Wetlands and Deep-Water Habitats of the United States*, Cowardin, et al, 1977. They are classified into over 45 categories. Each NWI map corresponds to a USGS 7.5 minute 1:25,000 quadrangle.

Polygon attributes for this datalayer include:

ATTRIBUTE = Wetland Classification

This is an alphanumeric field that corresponds to the standard NWI wetland classification scheme.

3.4.2 Exclusion Method

3.4.2.1 Hydrography

All areas that have MINOR_NUM corresponding to a surface waterbody will be mapped for exclusion.

3.4.2.2 Wetlands Conservancy Program

All areas with a WETCODE value not equal to 99 (Upland or non-wetland area) and with an area of greater than or equal to 50 acres will be mapped for exclusion.

3.4.2.3 Land Use

Areas with LU21_CODE of 4 (Inland Wetland) and 14 (Salt Marsh) and with an area of greater than or equal to 50 acres will be mapped for exclusion.

3.4.2.4 Estimated Habitats of State-Listed Rare Wetlands Wildlife

All polygons in this data set with an area of greater than or equal to 50 acres will be mapped for exclusion.

3.4.2.5 National Wetlands Inventory(NWI) Maps

All polygons with an ATTRIBUTE not equal to 'U' (Upland) and with an area of greater than or equal to 50 acres will be mapped for exclusion.

3.5 Coastal High Hazard Zones (43.21:1g)

3.5.1 Database Description

This consists of three separate data sets: Flood Plains, Barrier Beaches, and CBR (Coastal Barrier Resources).

3.5.2 Exclusion Method

All areas in each of the above mentioned coverages will be selected and mapped for exclusion.

3.6 Dam Inundation Areas (43.21:1h)

3.6.1 Database Description

The MDC has completed dam failure studies for the Quabbin Reservoir and the Sudbury/Framingham Reservoirs. Using computer models, the areas subject to inundation were determined, as was the expected magnitude of the flooding. This data exists in ARC/INFO format from the MDC.

3.6.2 Exclusion Method

All areas subject to inundation will be identified and mapped for exclusion.

3.7 Agricultural Land (43.29:1c)

3.7.1 Database Description

MassGIS is currently digitizing the soils maps for the state. The first area to be done is the Connecticut River Valley. The Natural Resources Conservation Service produces county soil surveys delineating the various soil types present in that area. These are usually compiled as a series of maps with the different soil classification boundaries drawn on top of a black-and-white aerial photograph. The soil classification is typically a code such as PaB where Pa is the soil unit name (Paxton fine sand loam) and B is the slope class (e.g., 3 to 8 percent). For each county, those soil classifications that contain agricultural soils are identified. Agricultural soils are classified as Prime, State Wide Importance, and Local importance. These classifications are based upon various criteria including slope, wetness, and soil fertility.

The polygon attributes for this coverage will include the soil classification and possibly the agricultural soil class, though the final database attribute scheme for this data layer is still under development at MassGIS.

3.7.2 Exclusion Method

All areas with an agricultural classification of 'prime' will be selected and mapped for exclusion.

3.8 Areas of Critical Environmental Concern (43.31:1a)

3.8.1 Description of Database

This data set shows the locations of areas that have been designated Areas of Critical Environmental Concern (ACEC) by the Secretary of Environmental Affairs. The data set was compiled by transferring the borders of each ACEC to USGS 1:25,000 quadrangles and digitizing them. Historically, approximately two new ACECs have been added each year.

The polygon attributes for this data include:

ACECID	Unique identifier for each area
NAME	The name of the ACEC
DES-DATE	The date the Secretary signed the designation
FEDCON-DATE	The date after which all activities requiring federal funding, licensing or permitting must be consistent with enforceable Coastal Zone Management (CZM) program policies (for CZM ACECs only)
SECRETARY	The name of the Secretary who signed the designation
AREA-ACRES	The area in acres of each polygon
ADMIN_BY	Agency responsible for the ACEC

3.8.2 Exclusion Method

All ACEC areas in the data set at the time of the statewide screening (summer 1996) will be mapped for exclusion.

3.9 Scenic Rivers and Streams (43.31:1b)

3.9.1 Description of Database

The statewide hydrography database will be used to identify those designated scenic and recreational rivers and streams. This database contains all the water features in the state. It is based on the USGS 1:100,000 scale Digital Line Graphs and has been enhanced by checking the data against 1:25,000 scale quadrangles. The data set is tiled by USGS 7.5 minute 1:25000 quadrangle. The Massachusetts Scenic Rivers Program maintains a list of the designated rivers, which defines the extent of the designation.

The line attributes for this data include:

MINOR_TOT	Concatenated feature code from USGS DLG major/minor pairs.
SOURCE	Data Source ENH = 1:100,000 enhanced DLG = 1:25,000 USGS DLG DIG = 1:25,000 Digitized Quads
MINOR_NUM	Same as MINOR_TOT

3.9.2 Exclusion Method

The designated scenic and recreational rivers and streams will be identified using the Massachusetts Scenic Rivers Program's list and paper quad sheets. Although the scenic rivers are not identified in the digital database as such, there are only two rivers which would need to be selected under this criteria. These rivers will be identified on the appropriate HD-<quad> and tagged as being designated. The designated rivers will then be copied into a new data set and

buffered 300 feet which corresponds to the designated river corridor. The buffered river corridors will be mapped for exclusion. Please note that all surface water bodies in this data set are mapped for exclusion (without a buffer) under the wetlands exclusion criterion.

3.10 Federally Protected Resources (43.31:1c)

3.10.1 Database Description

Three data sets will be used for this criterion, the MassGIS Protected and Recreational Open Space coverage, the Massachusetts Historic Commission's National Historic Register coverage, and the statewide hydrography coverage.

3.10.1.1 Protected and Recreational Open Space

This data set contains the parcel boundaries of conservation lands and recreational facilities. This data set is currently under development, and as such, the level of detail is not consistent across the state. Data for state and federal lands was compiled from 1:25,000 scale maps by the Department of Regional Planning and Landscape Architecture at the University of Massachusetts in Amherst. This data was verified and is maintained by each of the agencies of EOEA. Other open space parcels such as town forests are being added based on updates from volunteers coordinated by MassGIS. It should be noted that the data in this data set is not a legal record of ownership and are meant for planning purposes.

This data set contains 47 attributes relating to such things as the ownership of the parcel, the type of protection, the funding used to acquire the parcel, the type of public access afforded, its primary purpose, the level of protection, and other items. The key attributes for this exclusion criterion are those associated with the ownership of the parcel. These include the STATUS_OWNER, STATUS_MANAGER, STATUS_1, STATUS_2, and STATUS_3 fields. Multiple fields are required since there may be more than one legal party involved. The codes that describe the ownership are:

F	Federal
S	State
C	County
M	Municipal
N	Private Nonprofit
P	Private for Profit
B	Public Nonprofit
O	None of the Above
X	Unknown
I	Inholding (parcel of unprotected property surrounded by protected land)

Since this data set is under ongoing development, not all parcels contain all this information. This data set is tiled by county.

3.10.1.2 National Historic Register

This data set contains the point location of all National Register of Historic Places structures and the recognized National Register of Historic Places districts.

3.10.1.3 Hydrography

This data set contains all the rivers and ponds in the state and will be used to identify federally designated wild and scenic rivers. For a more detailed description of the data base see Section 3.9.1.

3.10.2 Exclusion Methods

3.10.2.1 Protected and Recreational Open Space

Those polygons with a STATUS_OWNER, STATUS_MANAGER, STATUS_1, STATUS_2, or STATUS_3 field code of 'F' (federal) will be selected and mapped for exclusion.

3.10.2.2 National Historic Register

Those areas which are National Register Historic Districts will be selected and mapped for exclusion.

3.10.2.3 Federally Designated Wild and Scenic Rivers

Sections of the Westfield River are the only federally designated wild and scenic river exists in Massachusetts at this time. The designated sections of this river will be identified using the description of the designated segments and paper quad sheets. These sections will be identified on the appropriate HD-<quad> and tagged as being designated. These sections will then be copied into a new data set and buffered 300 feet. The buffered river segments will be mapped for exclusion.

4. PROCEDURES

This section outlines the data processing steps required to identify and map the areas subject to exclusion for each of the 10 DEP exclusion criteria which will be applied statewide as described in Section 2.0. These procedures are written in a generic format rather than specifying the actual ARC/INFO commands to be used. In a few cases however, reference will be made to specific ARC/INFO commands and procedures.

The actual selection of exclusion areas and map production will be implemented through a series of ARC/INFO AML's. AML is the programming language used in ARC/INFO for automating procedures and creating specific end-user applications. Use of AML in this study will enable other users to more readily produce or update the maps on-demand.

Since this study is limited to existing digital data, no digitizing and only minimal data conversion will be performed. This, together with the multitude of data available from MassGIS, allows for most of the procedures to be straightforward, and it should be relatively easy for others to replicate the data processing steps.

4.1 General Procedures

The selection of the exclusion areas will be accomplished as part of the production process for the maps required for this study. The selection procedures for each criteria will be integrated into the ARC/INFO AMLs which will generate each of the required maps. This will allow each map to be produced using the most current MassGIS databases online at that time, thus assuring that the exclusion maps will represent the most current MassGIS data. It should be noted, however, that the digital databases maintained by MassGIS and others may be updated in the future, so replication of these data processing procedures, at some future time, may produce somewhat different exclusion maps. To ensure that a record copy of the data sets used to produce the final maps is retained, all data sets used in production of the final map sets, as well as the map composition files, will be archived either to 8mm tape or CD-ROM. The AMLs will be included as an Appendix to the Statewide Mapping and Screening Report.

The general procedure is to map the excluded areas by selecting the data set attributes detailed for each exclusion criterion and drawing these areas on the map using the appropriate symbology. The selection of the symbology to be used will depend on the map series being produced and will be chosen in consultation with the Board staff after examining the initial draft maps produced. The general outline of how the AML process will work is as follows:

1. Select map series to be produced. (Three map formats will be produced and are described in Section 4.12.1.)

2. Select which area of the state is to be mapped. (Format A and B maps will require multiple maps to cover the state.)

3. Select which exclusion criterion is to be mapped. (Depending on the map series being produced, a predetermined set of criteria will be combined on one map.)

4. AML program selects those areas meeting the exclusion criterion from the appropriate data set(s) and shades the areas using predetermined shade symbols.

5. AML program draws the map legend, titles, scale and neatlines.

6. Map composition is sent to plotter.

The key part of this process is Step 3 where the actual selection of the exclusion areas is performed. This will be different for each criterion and may entail selection from a single coverage, as is the case for state-wide data sets, or selection from multiple data sets, as is the case where the data set is tiled into multiple coverages. As an example, a portion of the code required to select the Class A Water Supplies is shown below:

```
/*_____________________________
/*Class A Water Supplies
/*_____________________________

/* Select all surface water supply, adjacent state, and
MDC/MWRA watersheds
reselect sub-%tile% polys WSP in {1,3,4}
/* Shade selected polygons using symbol 67
polygonshade sub-%tile% 67
/*Draw line around each polygon
linesym 101
polys sub-%tile%
&return
```

For those data sets that are tiled, this portion of code would be repeated for each tile. This code fragment would be a small portion of the overall program. The remaining portions are used to automate other tasks involved such as interacting with the user, drawing the base map, and drawing the map titles and keys.

Since this AML coding provides the detailed procedures which select the actual exclusion areas, it will be the main focus of the quality assurance program. That section of code which selects the exclusion areas for each criterion will be reviewed and the review will be documented as a quality assurance record. For each exclusion criterion to be applied in the Statewide Mapping and Screening, four areas of the state will be selected for an independent check. The AMLs will be used to select the excluded areas and these will be manually compared to the original database. This procedure is explained in greater detail in Section 5.4.

Exhibit 2 summarizes the 10 exclusion criteria to be applied statewide, indicates whether they apply to the entire site or only to the Waste Management Area (WMA), the data source, and the GIS data layers to be used.

Exhibit 2 Summary of Databases to be Used for Identifying Exclusion Areas

Exclusion Criteria	Type[3]	Source	Data Layers to be Used
Existing Public Water Systems	Site	MassGIS	ZONE_IIS, IWPA
Sole Source Aquifer	Site	MassGIS	SSA
Class A Water Supplies	WMA	MassGIS	SUB-<basin name>
Wetlands	WMA	MassGIS, NWI	HD-<tile>, WET-<tile>, LU-<town>, WETHAB95, NWI<quadname>
Coastal High Hazard Zones	Site	MassGIS	COAST_HAZ
Dam Inundation Area	Site	MDC	QUABBIN, WAYLAND
Agricultural Land	Site	MassGIS	SOILS-<tile>
Areas of Critical Environmental Concern	Site	MassGIS	ACEC
Scenic Rivers and Streams	Site	MassGIS	HD-<tile>
Federally Protected Land	Site	MassGIS	OS_<tile>, HISTORIC, HD-<tile>

All data will be projected into the Massachusetts State Plane coordinate system in meters using the North American Horizontal Datum of 1983 (NAD83), if not already in this map projection. This projection will be done prior to the start of the selection of the exclusion areas.

4.2 Existing Public Water Systems

4.2.1 Databases to be Used

ZONE_IIS - Zone II Wellhead Protection Areas from MassGIS

IWPA - Interim Wellhead Protection Areas from MassGIS

[3] From DEP regulation 310 CMR 43.00

4.2.2 Selection of Exclusion Areas

1. Select all polygons in both ZONE_IIS and IWPA coverages. These correspond to an approved Zone II and Interim Zone II respectively.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.3 Sole Source Aquifer

4.3.1 Databases to be Used

SSA - Sole Source Aquifers from MassGIS

4.3.2 Selection of Exclusion Criteria

1. Select all polygons in this coverage for exclusion.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.4 Class A Water Supplies

4.4.1 Databases to be Used

SUB-<Basin Name> - Sub-Basins from MassGIS

4.4.2 Selection of Exclusion Criteria

1. For each of the 20 SUB-<basin> coverages, select those polygons where WSP includes 1, 3, or 4.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.5 Wetlands

Five data layers will be used for this exclusion criterion. Each of these will require different procedures due to differences between the databases. There will be cases where more than one of the five databases will have the same entity that has a slightly different shape and size. There will be no attempt made to reconcile these minor differences among the wetland data at the statewide mapping stage. Rather, each of the five data sets will be combined, and the overall area mapped for exclusion. This procedure may tend to slightly overestimate wetland exclusion areas at the statewide scale.

4.5.1 Databases to be Used

HD-<quad> - enhanced hydrography from MassGIS

WET-<tile> - Wetland Conservancy Program Wetlands from MassGIS

LU-<town> - 1985 Land Use from MassGIS

WETHAB95 - Wetland Habitats from NHESP

NWI<quadname> - NWI Wetlands From U.S. Fish and Wildlife

4.5.2 Selection of Exclusion Criteria

HD-<quad>

1. For each tile select all polygons whose MINOR_NUM include: 101 (reservoir), 402 (gravel pit with water), 414 (ditch/canal), 421 (lake or pond), 101619 (reservoir), 101625 (reservoir), 109421 (sewage pond), 109611 (sewage pond - abandoned), 109619 (sewage pond), 115421 (flats/pond), 412115 (stream flats), 415625 (stream), 421007 (lake or pond), 421619 (lake or pond), 421625 (lake or pond), 421628 (lake or pond), 619101 (reservoir), 619412 (stream), 619421 (lake or pond), 101619625 (reservoir), 421619625 (lake or pond), 421625619 (lake or pond), 619625415 (aqueduct), 619625421 (lake or pond).

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

WET-<tile>

1. For each tile select those polygons whose WETCODE is not equal to 99 (upland or non-wetland area) or 9 (open water) and whose area is greater than or equal to 50 acres.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

LU-<town>

1. For each town select those polygons whose LU21_CODE include 4 or 14 and whose area is greater than or equal to 50 acres. These codes represent Inland Wetlands and Salt Marsh.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

WETHAB95

1. Select all polygons in this data set whose area is greater than or equal to 50 acres.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

NWI<quadname>

1. Download from the U.S. Fish and Wildlife NWI ftp site (192.189.43.33) all available quads for Massachusetts. The actual number available is unknown at this time, since the production of these is ongoing. This data exists in separate directories based on the 1:250,000 quad names. Thus, under the 'Boston' directory, there are all the available NWI data by 7.5 minute quadname.

2. Using the AML's supplied by Fish and Wildlife convert all the retrieved datafiles to ARC/INFO format and project into Massachusetts State Plane NAD83.

3. Select for each NWI quad, those polygons whose ATTRIBUTE is not equal to 'U' (upland or non-wetland area) and whose area is greater than or equal to 50 acres. Note that the name of the item which identifies the wetlands is not consistent, and will have to be checked for each tile.

4. Produce statewide overlay check plot.

5. Produce quality assurance plots for four selected geographic areas.

Final Wetlands Exclusion

1. Produce statewide overlay check plot by combining each of the above on a single map.

4.6 Coastal High Hazard Zones

4.6.1 Databases to be Used

COAST_HAZ

4.6.2 Selection of Exclusion Areas

1. Select all polygon areas that are part of the databases that comprise the coastal high hazard zone datalayer.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.7 Dam Inundation Areas

4.7.1 Databases to be Used

Inundation coverages for Quabbin and the Sudbury/Framingham Reservoirs. This data is available from the MDC. This data should be reviewed carefully and any potential problems noted before beginning the exclusion mapping.

4.7.2 Selection of Exclusion Criteria

1. Select areas subject to inundation from each of these coverages.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.8 Agricultural Land

4.8.1 Databases to be Used

SOILS-<tile> Note: This database is under development and is expected to be ready for the area covering the Connecticut River Valley by the time the actual statewide mapping begins (summer, 1996). The exact contents of the database are unknown at this time.

4.8.2 Selection of Exclusion Criteria

1. Select for each SOILS-<tile> those polygons whose FARMSOIL type is 'PRIME'. Optionally, if this attribute is not present, select out those soil codes that have been designated prime farmland by the USDA for this area. A list of the correspondence between soil classifications and farmland soils are available from the Natural Resources Conservation Service. These differ from county to county.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.9 Areas of Critical Environmental Concern

4.9.1 Databases to be Used

ACEC

4.9.2 Selection of Exclusion Criteria

1. Select all polygons where NAME is not equal to ' ' (blank). Areas with no ACEC name are inholdings.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

4.10 Scenic Rivers and Streams

4.10.1 Databases to be Used

HD-<quad>

Scenic Rivers Program designated river list (paper). This is one of only two criteria for which the database will have to be manipulated by tagging and isolating stream lengths and buffers designated as scenic.

4.10.2 Selection of Exclusion Criteria

1. Using the Scenic Rivers Program designated list, the beginning and end point of the extents of each designated river and stream will be marked on a USGS 1:25,000 paper quad. This delineation will be checked.

2. Using the appropriate HD coverage, the designated river or stream will be selected using the marked quad sheets and PUT into a new coverage called SCRIV, making sure that the entire length of the designated river is included.

3. The arcs for each of the designated rivers will be split at the beginning and end points as shown on the quad sheets and the sections outside of the designated area deleted.

4. A check plot will be made of each designated river at 1:25,000 scale on clear mylar. These plots will show the quad tic marks and the designated river or stream. These will be compared to the original paper quad and any differences noted.

5. Any changes indicated on the check plot will be made to SCRIV.

6. Buffer SCRIV by 300 feet to make SCRIV-EX.

4.11 Federally Protected Resources

4.11.1 Databases to be Used

OS-<tile>

Historic Districts

HD-<quad>

4.11.2 Selection of Exclusion Criteria

OS-<tile>

1. For each tile select out those polygons where STATUS_OWNER, STATUS_MANAGER, STATUS_1, STATUS_2, or STATUS_3 attributes are equal to 'F' (Federal).

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

Historic Districts

1. Select out from the historic districts all areas tagged as being National Register of Historic Places districts.

2. Produce statewide overlay check plot.

3. Produce quality assurance plots for four selected geographic areas.

Wild and Scenic Rivers

1. Using the Wild and Scenic Rivers designated river segment descriptions, the beginning and end point of the extents of each designated segment will be marked on a USGS 1:25,000 paper quad. This delineation will be checked.

2. Using the appropriate HD coverage, the designated segment will be selected using the marked quad sheets and PUT into a new coverage called FEDRIV, making sure that the entire length of the designated segment is included.

3. The arcs for each of the designated segment will be split at the beginning and end points as shown on the quad sheets and the sections outside of the designated area deleted.

4. A check plot will be made of each designated segment at 1:25,000 scale on clear mylar. These plots will show the quad tic marks and the designated segment. These will be compared to the original paper quad and any differences noted.

5. Any changes indicated on the check plot will be made to FEDRIV.

6. Buffer FEDRIV by 300 feet to make FEDRIV-EX.

Final Federal Land Exclusion

Produce statewide overlay check plot by combining each of the above on a single map.

4.12 Map Output

Three map formats will be produced as part of the study:

- Format A: Large format (48" x 36") at a scale of 1:100,000.
- Format B: Statewide maps at a scale of 1:250,000.
- Format C: Statewide summary maps at a scale of 1:250,000.

The specific design and content of each map will be determined in consultation with the Board. The design and content will depend on the extent of each exclusion criteria. The final design and production of all maps will be done using AMLs to facilitate reproducibility of each map at future dates.

4.12.1 Format A Maps

These maps will be produced at a scale of 1:100,000 on 48" x 36" sheets. At this scale, approximately 12 sheets will be required to fully cover the state. This map series will be primarily used for presentation purposes. The base for each sheet will be the full MassGIS basemap which includes the transportation network, hydrography, political boundaries, and major feature names. Exclusion criteria will be plotted on clear film that will overlay each base sheet. Approximately 3 to 4 exclusion criteria will be plotted on each overlay. The choice of which criteria will be shown together will depend on the results of the screening study, however, the criteria shown on each sheet should be thematically related. Those criteria that are specific to the Waste Management Area will be plotted together on a separate overlay.

4.12.2 Format B Maps

This map series will be produced at two sizes, 48"x36" for presentations, and 11" x 17" report sized sheets at a scale of 1:250,000. These maps will be designed as clear summaries of each exclusion criterion and will also include information about each exclusion criterion shown. This will include the source of the data, how the exclusion areas were selected, and statistics of the amount of area excluded in acres and percent of total land area. Base map data will generally be limited to political boundaries and town names. Additional base map information may be included, depending on the complexity of the exclusion criteria being shown.

4.12.3 Format C Maps

These maps will be statewide summary maps, one 36" x 43" presentation map and one 11" x 17" report size map. The scale of the presentation map will be approximately 1:250,000 and the report size map approximately 1:760,000 (1" = 12 miles). These maps will show all of the exclusion areas together with no differentiation among individual exclusion criteria. Areas excluded will be shaded one color, areas not excluded another.

5. QUALITY ASSURANCE

5.1 Federal Regulatory Requirements

Federal regulations (10 CFR 61.12(j)) require that a license application for an LLRW disposal facility include a description of the quality assurance program applied to determine the characteristics of the disposal site. A quality assurance program is also required to control the design, construction, operation and closure of the facility and the receipt, handling and placement of waste. U.S. Nuclear Regulatory Commission requirements for an acceptable quality assurance program are provided in NUREG-1293, Quality Assurance for Low-Level Radioactive Waste Disposal Facility. These requirements are not generally applicable to Statewide Mapping and Screening activities because of the preliminary nature of this work and the broad area data on which it is based.

It is the Board's position that data and analyses from the statewide mapping and screening stage of the siting process will not be used for facility design, or to support a license application demonstrating that the site and facility will meet regulatory performance objectives, until it has been confirmed by detailed site characterization. Therefore, under the federal regulations, a quality assurance program meeting the requirements of NUREG-1293 is not required for the Statewide Mapping and Screening activities. The site-specific investigations and analysis, performed later in the siting process, will provide the basis for all licensing and design activities and these must be carried out under a quality assurance program in full compliance with the regulations cited above.

5.2 Massachusetts Regulatory Requirements

The Massachusetts DEP site selection criteria in 310 CMR 43.43 provide general guidance for quality assurance applicable to screening and site evaluation. Those general requirements applicable to the scope of the statewide mapping and screening study are summarized below.

1. At each stage of the site evaluation process, the Board is required to develop and implement a quality assurance program designed to ensure data reliability, validity, traceability, retrievability, completeness and technical accuracy. The quality assurance program for each stage must be commensurate with the type of data being collected, the scope of data collection and analysis and the applicable regulations.

2. Analytical map work must be conducted by qualified professionals experienced in the use of GIS and knowledgeable in the field of cartography.

3. The GIS and map work must be performed in substantial accordance with professional standards or generally accepted protocols and uniform procedures for the collection, analysis and presentation of mappable data.

4. Records of qualifications for persons employed in data gathering and analysis must be maintained in the Board's files.

In order to fully comply with the quality assurance guidance given in the DEP siting regulations, and to provide a uniform framework for quality assurance programs that the Board will need to implement for future site characterization and licensing activities, a Project Quality Assurance Program applicable to the limited scope of Statewide Mapping and Screening is required.

5.3 Statewide Mapping and Screening Quality Assurance Program

The Statewide Mapping and Screening Quality Assurance Program is based on the Foster Wheeler Environmental Corporate Quality Assurance Program and NUREG-1293, and prepared using a graded approach to identify the specific requirements applicable to the limited scope of the Statewide Mapping and Screening study. The Foster Wheeler Environmental Corporate Quality Assurance Program was developed and formatted to meet the requirements of ANSI/ASME NQA-1 and U.S. Department of Energy Order 5700.6. As such, it addresses the applicable requirements for all 18 quality assurance criteria described in NUREG-1293.

Following is an outline for the Project Quality Assurance Program for Statewide Mapping and Screening identifying those aspects of the 18 NUREG-1293 criteria which are applicable to this study, as it is defined in this Protocol and Procedures document, and required to meet the general quality assurance guidance given in the DEP regulations (310 CMR 43.43):

Criterion 1 - Organization

Applicable. Description of the Project Management and Q.A. organization, roles and responsibilities of key personnel, and professional qualifications for GIS analysts.

Criterion 2 - Quality Assurance Program

Applicable. Description of scope and graded approach to implementing Q.A. requirements. Review and approval of the Project Quality Assurance Program.

Criterion 3 - Design Control

Applicable. Requirements for verification and documentation of GIS software used and for review of the draft Statewide Mapping and Screening Report.

Criterion 4 - Procurement Document Control

Not Applicable.

Criterion 5 - Instructions, Procedures, Drawings

Applicable. Requirements for use of the GIS mapping procedures contained in Section 4 of this Protocol and Procedures document, and for documenting and approving changes to these procedures.

Criterion 6 - Document Control

Applicable. Distribution and control requirements for the final Protocol and Procedures document, the Project QA Program and review copies and comments on the draft Statewide Mapping and Screening Report.

Criterion 7 - Control of Purchased Material, Equipment and Services

Not Applicable.

Criterion 8 - Identification and Control of Material, Parts, and Components

Not Applicable.

Criterion 9 - Control of Processes

Not Applicable.

Criterion 10 - Inspection

Not Applicable.

Criterion 11 - Test Control

Not Applicable.

Criterion 12 - Control of Measuring and Test Equipment

Not Applicable.

Criterion 13 - Handling Storage and Shipping

Not Applicable.

Criterion 14 - Inspection, Test and Operating Status

Not Applicable.

Criterion 15 - Nonconforming Materials, Parts or Components

Not Applicable.

Criterion 16 - Corrective Actions

Applicable. Requirements to correct errors or nonconformances with established GIS mapping procedures and to take actions to prevent recurrence.

Criterion 17 - Quality Assurance Records

Applicable. Requirements for collection, filing, storage and disposition of records including personnel qualifications, procedures, computer operating logs and AMLs, audit and surveillance reports, review comments and their disposition, and the digital data sets as they exist at the time the statewide screening maps are prepared.

Criterion 18 - Audits, Surveillance and Managerial Controls

Applicable. Requirements for regular surveillance reviews to determine whether the GIS mapping work and products conform to the established procedures, and to document any nonconformances for corrective action. Requirements for a final audit of project records to ensure complete documentation of the Statewide Mapping and Screening activities and work products.

5.4 Quality Assurance Procedures for Statewide Mapping and Screening

The scope of the Statewide Mapping and Screening is limited to selection and mapping of available digital data sets applicable to the DEP exclusion criteria, and judged suitable for mapping at the scale of statewide screening, as described in Sections 2 and 3 of this Protocol and Procedures document. Most of the applicable data sets are included in a database developed and maintained by the MassGIS in accordance with their established standards and extensive quality assurance procedures. No new data are planned to be collected, digitized or entered into the GIS under the scope of the Statewide Mapping and Screening. This greatly simplifies the quality assurance procedures since development of original data would require extensive quality controls to ensure that the data captured, either by manually digitizing or scanning, accurately matches the original manuscripts. This process is highly time-consuming because it involves manually checking the digitized line work against each manuscript, correcting errors and repeating the process.

The quality assurance procedures that will be used for this study are designed to ensure that the excluded areas of the state are correctly identified and mapped in accordance with Sections 2 through 4 of this Protocol and Procedures document. This will be done by reviewing AMLs that are written to select the screening data and sampling selected map areas for manual comparison with the original data set. Sample areas will be selected from four different geographic locations within the state and comparison checks will be made for each data set used. Thus, for example, since the wetlands exclusion criterion uses multiple data sets from different sources, the comparison check will be performed separately for each data set. This procedure will be done by selecting an area corresponding to a 7.5 minute USGS quad sheet and plotting the original data

sets with each polygon labeled or shaded to indicate the specific exclusion criterion attribute. The corresponding exclusion map will be plotted on clear film at the same scale and overlaid on the plot of the original data sets. Any discrepancies between the two plots will be identified and appropriate corrections made to the exclusion map data set. If significant discrepancies, indicative of a trend, are observed for any data set, the entire statewide data set will be checked and resolved using a similar procedure.

Two quality control forms will be completed for each exclusion criterion. The Procedures Tracking Form provides a means of tracking the status of each exclusion criterion data set from initial production of the check plots to the final map production. The Procedure Control Form is used to identify any problems noted for a data set and to document any variations made from the mapping procedures established in this Protocol and Procedures document. A copy of each form is provided in Appendix B.

Appendix A

Site Selection Criteria for Low-Level Radioactive Waste Management Facilities (310 CMR 43.00)

310 CMR 43.00: SITE SELECTION CRITERIA FOR LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT FACILITIES

Section

43.01: Purpose and Authority
43.02: Definitions
43.03: Applicability
(43.04 through 43.09: Reserved)
43.10: Modeling Capability
(43.11 through 43.19: Reserved)
43.20: Groundwater Drinking Supply and Resource Protection
43.21: Surface Water Drinking Water Supply and Resource Protection
43.22: Tectonic Processes
43.23: Surface Geologic Processes
43.24: Demography
43.25: Site Size and Facility Compatibility
43.26: Compliance with Department of Public Health Performance Objectives
43.27: Meteorology and Climatology
43.28: Transportation
43.29: General Land Use
43.30: Air Quality
43.31: Protected Lands and Environments
(43.32 through 43.39: Reserved)
43.40: Application of Criteria Guidelines
43.41: Requirements for a Technically Superior Site
43.42: General Guidance in Site Selection and Characterization Methodology
43.43: General Guidance in Quality Assurance
43.44: Application Guidelines and Procedures for Use in Preparation of the Statewide Mapping and Screening Report
43.45: Specific Guidance for the Application of Particular Conditions for Statewide Mapping and Screening
(43.46 through 43.49: Reserved)
43.50: Application Guidelines and Procedures for Use in Preparation of the Report Identifying Possible Locations
43.51: Specific Guidance for the Application of Particular Conditions for Report Identifying Possible Conditions
(43.52 through 43.59: Reserved)
43.60: Guidelines and Procedures for Use in Preparation of the Candidate Site Identification Report
43.61: Specific Guidance for the Application of Particular Conditions for Candidate Site Identification Report
43.62: Quality Assurance Requirements
(43.63 through 43.69: Reserved)
43.70: Application Guidelines and Procedures for Use in Preparation of the Detailed Site Characterization Report
43.71: Specific Guidance for the Application of Particular Conditions For Detailed Site Characterization
43.72: Quality Assurance Requirements

43.01: Purpose and Authority

(1) Purpose. 310 CMR 43.00 is composed of criteria for the selection of a superior site for a low-level radioactive waste management facility; guidelines for the application of the criteria; and procedures for conducting selection of a superior site. The regulations shall be interpreted so as to be compatible with the federal regulatory program for the management of low-level radioactive waste and shall as a primary consideration be protective of the public health, safety and the environment.

310 CMR 43.01 through 43.09 establishes the Department's purpose and authority and the regulations' general applicability. 310 CMR 43.10 through 43.39 establishes location criteria for identifying a superior site for a low-level radioactive waste facility. The criteria are intended to identify site characteristics which will contribute to the isolation of the waste, minimize the likelihood of exposure to the public or the environment in the event of a release and mitigate the incidental adverse impacts from waste management activities at the site.

310 CMR 43.40 through 43.72 specifies the procedures for selecting a superior site and guidelines for the collection, analysis and presentation of data necessary to evaluate and characterize a potential site at each stage of the site selection process specified by the Massachusetts Low-Level Radioactive Waste Management Act (M.G.L. c. 111H, §§ 19 through 24). 310 CMR 43.40 through 43.72 is intended to ensure that the characterization of a potential site is based on accurate, verifiable, comprehensive and well documented data and analytical procedures. 310 CMR 43.40 through 43.72 is also intended to ensure that the scope of data collection and site characterization is compatible with the level of decision making to be applied at each stage of the site selection process.

(2) Authority. 310 CMR 43.00 is promulgated by the Department of Environmental Protection pursuant to M.G.L. c. 111H, § 14.

43.02: Definitions

The following words and phrases when used herein shall have the following meaning:

Adverse Effect means an injurious impact which is reasonably significant in relation to the public health, safety, or environmental interest being protected.

Aquifer means a geologic formation, group of formations, or part of a formation that is capable of yielding significant quantities of ground water to wells or springs.

Board means the Low-Level Radioactive Waste Management Board established in M.G.L. c. 111H, § 2.

Buffer Zone means a parcel of land which is an integral part of a facility that is controlled by the facility licensee and acts as a surrounding boundary to the facility.

Chief Municipal Official means the city manager in any city having a city manager, the mayor in any other city, the town manager in any town having a town manager or the chairperson of the Board of Selectmen in any other town.

Coastal High Hazard Zone means coastal zones identified by the Office of Coastal Zone Management which are subject to any inundation caused by coastal storms up to and including that caused by the 100 year storm, surge of record or storm of record which ever is greater including coastal beaches, coastal dunes, barrier beaches, coastal banks and rocky intertidal shores as those terms are defined in 310 CMR 10.27 through 10.31.

Community means a city or town of the Commonwealth.

Community Water System means a public water system which serves at least 15 service connections used by year round residents or regularly serves at least 25 year round residents.

Department means the Department of Environmental Protection.

Detailed Site Characterization means the on-site investigatory and analytical step of site selection established in M.G.L. c. 111H, § 23 and conducted prior to the selection of any superior site.

DPH Performance Objectives means the performance objectives contained in regulations promulgated by the Department of Public Health at 105 CMR 120.811 through 120.814.

Dissolution means a space or cavity in or between rocks, formed by the solution of part of the rock material.

Disposal means the isolation of low-level radioactive waste from the biosphere inhabited by human beings and their food chain.

Downgradient means in a direction exactly opposite to upgradient (q.v.).

43.02: continued

DPH means the Department of Public Health.

Economically Recoverable Resources means oil, gas, fossil fuels, sulphur, metals, ores, minerals, rock, soil, sand and gravel which because of their high quality, economic superiority or quantity are being exploited or are likely to be exploited in the reasonably foreseeable future.

Engineered Barrier means a man-made structure or device that is intended to improve a facility's ability to meet DPH performance objectives.

Environmental Monitoring Program means a monitoring program established by DPH, after consultation with the Department and the board of health of each site community, pursuant to M.G.L. c. 111H, § 36 for the purpose of collecting and analyzing environmental data prior to construction and throughout the construction, operation, closure, post-closure observation and maintenance and institutional control of a facility.

Facility means a parcel of land, together with the structures, equipment and improvements thereon or appurtenant thereto, which pursuant to M.G.L. c. 111H, is being developed, is used, or has been used for the treatment, storage or disposal of low-level radioactive waste; but does not include any property used for temporary storage of low-level radioactive waste in sealed containers by a broker.

Fault means a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side.

Five Hundred Year Floodplain means the estimated maximum lateral extent of flood water rising from creeks, rivers, streams, ponds, or lakes as result of a flood discharge of a magnitude likely to occur on the average of once every 500 years or, more properly, has a 0.2% chance of being exceeded in any year.

Flammable Liquid means a liquid whose flash point is less than 100°F.

Geographic Information System [GIS] means a computer based information handling program maintained by the Commonwealth that can store and manipulate both map-based information and associated tabular data such as zip codes or population density.

Ground Water means all the water below the land surface in soils or geologic formations, specifically that part of the subsurface water in the saturated zone except as otherwise defined by 310 CMR 22.00.

Hazardous Waste means a waste or combination of wastes, which because of its quantity, concentration or physical, chemical or infectious characteristics may cause, or significantly contribute to an increase in serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health, safety, public welfare or the environment when improperly treated, stored, transported, used or disposed of or otherwise managed, however not to include solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act of 1967 as amended, or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as further described in 310 CMR 30.000.

Holocene means the most recent epoch of the Quaternary period extending from the end of the Pleistocene Epoch to the present.

Horizontal Gradient means the change in static head per unit of distance along a flow path.

43.02: continued

Hydraulic Conductivity means a characteristic property of a porous medium that measures the ability of water to move through it under a difference in hydraulic potential or head. If a porous medium is isotropic and the fluid is homogeneous, the hydraulic conductivity of the medium is the volume of water at the existing cinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

Hydrogeologic unit means any soil or rock unit or zone which, by virtue of its porosity and permeability, or lack thereof, has a distinct influence on the storage or movement of groundwater.

Important to the Safety means those engineered structures, systems and components essential to the isolation of waste and prevention of a release of radioactivity which would result in an exposure in excess of DPH performance objectives.

Institutional Control means the continued observation, monitoring and care of a facility following transfer of the facility license from the operator to the Board.

Interim Wellhead Protection Area (IWPA) means:

(a) with respect to public water supplies and well fields whose pumping rate is 100,000 gallons per day or greater and for which the Department has not approved a hydrologically delineated Zone II, the ½ mile radius surrounding such well or well field; and

(b) with respect to public water supplies and well fields whose pumping rate is less than 100,000 gallons per day and for which the Department has not approved an hydrologically delineated Zone II, the radius calculated by multiplying the maximum pumping rate in gallons per minute for such well and well field by 32 and adding 400 feet thereto (*i.e.* IWPA = (32) X (y) + (400); where y = pumping rate in gallons per minute.

Liquefaction means the potential of certain soils to be transformed from a solid to liquid state as a result of increased pore pressure and reduced effective stress, such as might result from certain seismic loading conditions.

Lithified Earth Material means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil or regolith lying at or near the earth surface.

Low-Level Radioactive Waste means radioactive material that:

(a) is neither high-level waste nor spent nuclear fuel, nor by-product material as defined in section 11(e)(2) of the Atomic Energy Act of 1954, as amended, 42 USC Section 2014(e); and

(b) is classified by the Federal Government as low-level radioactive waste, but not including waste which remains a federal responsibility, as designated in section 3(b) of the Low-Level Radioactive Waste Policy Act, as amended, 42 USC Section 2021c(b), as in effect on the effective date of the Act.

Management means the storage, packaging, treatment, transportation or disposal, where applicable of low-level radioactive waste.

Mass Wasting means the movement of rock or soil material under the influence of gravity either as the movement of the product of weathering down a slope or as mass movement of rock or soil along joint planes or bedding planes. Mass wasting includes but is not limited to creep, mud flows, earth flow, soil flow, rock avalanche, landslide, landslip and slumping.

Maximum Horizontal Acceleration in Lithified Earth Material means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a 90% or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

43.02: continued

Mixed Waste means low-level radioactive waste containing material that either:

(a) is listed in 310 CMR 30.131 through 30.136; or

(b) causes the waste to exhibit any of the characteristics identified in 310 CMR 30.120.

Model means a conceptual description and the associated mathematical, graphical and/or analogous representation of a system, subsystem, component or condition that is used to predict changes from a baseline state as a function of internal and/or external stimuli and as a function of time and space.

Monitoring means observing and making measurements to provide data on a facility, its site, its surrounding environment, and its health, safety and environmental impacts.

Outstanding Resource Waters means waters in the Commonwealth given a protected status due to their ecological, socioeconomic, recreational and/or aesthetic value pursuant to 314 CMR 4.04(3).

Non-Community Water System means a public water system that is not a community system.

One Hundred Year Floodplain means the estimated maximum lateral extent of flood water rising from creeks, rivers, streams, ponds, or lakes as the result of a flood discharge of a magnitude likely to occur on the average of once every 100 years or, more properly, has a 1% chance of being exceeded in any year.

Overburden means all material that lies between the ground surface and bedrock.

Performance Assessment means a comprehensive analysis that:

(a) identifies the processes and events that might affect the site, and, if practicable, the waste management area or facility;

(b) examines the effects of these processes and events on the performance of the site, and, if practicable the waste management area and facility; and

(c) estimates the cumulative releases of radionuclides, considering the associated uncertainties caused by all the significant processes and events. These estimates shall be incorporated into an overall probability distribution of the projected cumulative distributions to the greatest extent practicable.

Population Density means the number of people residing in one square mile, as averaged over an area designated by the U.S. Bureau of Census.

Possible Location means a location, identified in accordance with the procedures established in M.G.L. c. 111H, § 20, which will be the subject of a preliminary characterization.

Potential Non-Community Water System means a Class I aquifer, as defined in 314 CMR 6.03(1), capable of yielding water of sufficient quality and quantity for a non-community water system and which is located under a parcel of land that at the time of the issuance of the statewide mapping and screening report pursuant to M.G.L. c. 111H, § 20(a) is:

(a) capable of being developed as a non-community water system under applicable community land use controls; and

(b) within the boundaries established by state regulations and guidelines for the location of a non-community water system.

Potential Private Ground Water Source means a Class I aquifer, as defined in 314 CMR 6.03(1), capable of yielding water of sufficient quality and quantity for a drinking water supply and which is located under a parcel of land that at the time of the issuance of the statewide mapping and screening report pursuant to M.G.L. c. 111H, § 20(a) is:

(a) capable of being developed for residential use under applicable community land use controls; and

(b) within the boundaries established by state regulations and guidelines for the location of private wells; and

(c) not within an area being served by a public water system.

Potential Productive Aquifer means all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer, and all aquifers located east of the Cape Cod Canal (Cape Cod), on Martha's Vineyard, on Nantucket and on the Elizabeth Islands.

Preliminary Characterization means the investigatory and analytical step established in M.G.L. c. 111H, § 20, and conducted prior to the identification of candidate sites.

Protected Area means land or resources which have been restricted from siting a facility pursuant to state or federal laws or regulations in order to promote, protect or preserve its ecological, wilderness, historic, recreational, archeological, cultural or scenic value including, without limitation, the state and federal areas listed at Appendix A, provided that the designation of land as a protected area herein is not intended to expand, diminish or otherwise modify the scope of protection provided by said statutes or regulations in relation to the exercise of authority to acquire land or interests therein pursuant to M.G.L. c. 111H, § 23(g). Protected areas do not include lands or resources restricted from development pursuant to municipal by-laws, ordinances or regulations.

Public Water Supply means a source of ground water or surface water supplying a public water system.

Public Water System means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of a least 25 individuals daily for at least 60 days of the year.

Qualified for Development means a potential productive aquifer which the Department determines is capable of being developed into a public water system based upon the following demonstrations:

(a) Geologic and hydrogeologic maps and, if available, local subsurface or hydrogeologic reports demonstrate that the aquifer meets the definition of a potential productive aquifer; provided, however, approved pump tests may be conducted to demonstrate that the source is incapable of yielding sufficient volumes of water to economically supply a public water system and is capable of yielding a quality which meets drinking water quality standards or can be cost efficiently treated;

(b) The source is necessary to supply one or more communities with sufficient water based on a minimum twenty year planning criteria used by the Department in the event that, after appropriate water quality testing, the largest current ground water sources in each community in the affected water basin is shut down.

(c) A site specific land use survey within the Interim Wellhead Protection Area demonstrates that existing or historical land uses will not preclude the use of the aquifer as a source.

Radioactive Material means any solid, liquid or gas which emits radiation spontaneously.

Radioactivity means the transformation of unstable atomic nuclei by the emission of radiation.

Radionuclide means an isotope that eventually undergoes spontaneous disintegration, with the emission of radiation.

Saturated Zone means any portion of the earth below the land surface where every available opening (pore, fissure, joint, or solution cavity) is filled with water under pressure equal to or greater than atmosphere, except as otherwise defined by 310 CMR 22.00.

Seismic Impact Zone means an area with a 10% or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g within 250 years or such extended time period in which projections can be made within reasonably conservative confidence limits.

43.02: continued

Sensitive Populations means persons who because of their age, health status or physical characteristics have a significantly higher probability of suffering an adverse effect to health than a member of the general public if exposed to a release of radioactivity or associated toxic materials managed at the facility. Examples of such sensitive populations may include, but are not limited to, children, infirm persons, pregnant women and persons who have experienced acute or chronic exposures to higher than normal doses of radioactivity due to occupational or geographic circumstances.

Sensitive Population Locations means structures or areas which are principally designated or designed to serve sensitive populations or which are predominantly used by sensitive populations for extended periods of time. Examples of such places may include: day care facilities, grammar and secondary schools, playgrounds, bedded hospitals or radiation or prenatal clinics.

Shallow Land Burial means a land disposal method that relies on the site's natural characteristics as the primary barrier for isolation of the waste.

Significantly Higher Than Normal Risk means a significantly greater degree of risk of an adverse effect to health than the degree of risk which the general population would be exposed to in the event of a release of radioactive or hazardous waste managed at the facility.

Site means a parcel of land which, pursuant to M.G.L. c. 111H, is being considered, developed or used or has been used as a location for a facility.

Slumping means landsliding characterized by movement of a generally independent mass of rock or earth along a slip surface and about an axis parallel to the slope rim which it descends and by backward tilting of the mass with respect to that slope so that the slump surface often exhibits a reversed slope facing uphill.

Sole Source Aquifer means an aquifer so designated by the U.S. Environmental Protection Agency, or by the Department under the authority of a state program as may be established, that supplies 50% or more of the drinking water for the aquifer service area, and the volume of water which could be supplied by alternative sources is insufficient to replace said aquifer should it become contaminated.

Storage means the holding of low-level radioactive waste for treatment or disposal.

Subsidence means the process by which the earth's surface sinks, either rapidly or slowly, with little or no horizontal motion.

Subsurface Dissolution means a process of chemical weathering by which minerals and rocks are dissolved in groundwater; evidenced by subsidence, widened fractures, sinkholes, caverns and/or underground streams.

Suitable Technology means a management technology which is qualified by the Board pursuant to regulations promulgated pursuant to M.G.L. c. 111H, § 12 as being suitable to manage low level radioactive waste within the Commonwealth.

Superior site means any site selected by the Board, after detailed site characterization, pursuant to M.G.L. c. 111H, § 23.

Transient population means people who do not reside within an area, but do pass through or spend a limited amount of time within an area, including, but not limited to, tourists, seasonal workers or sportsmen.

Tributary means a body of running water, including a river, stream, brook and creek, which moves in a definite channel in the ground due to a hydraulic gradient and which flows ultimately into a free flowing surface water supply. A tributary shall include the land over which the water runs and the banks thereto.

Upgradient means:

(a) in reference to surface water, the direction perpendicular to lines of equal water surface elevation over a distance in which elevation continuously increases, measured from the point or area in question; or

(b) in reference to ground water, the direction perpendicular to lines of equal total hydraulic head over a distance in which total head continuously increases, measured at the water table.

Upland Drainage Area means areas or drainage basins that could discharge surface runoff to or through portions of the site, either by overland flow or by means of streams, rivers, and well defined drainage courses.

Urban Area means an area designated as such by the U.S. Census in accordance with its detailed published criteria.

Waste means low-level radioactive waste unless otherwise specifically designated herein.

Waste Management Area means that portion of a facility where low-level radioactive wastes has been, is being, or will be treated, stored or disposed of.

Watershed means a region or area measured in a horizontal topographic divide which directs surface runoff from precipitation, normally by gravity, into a stream or a body of impounded surface water, except as otherwise defined by 310 CMR 22.00.

Water Table means that surface in an unconfined water body at which the pressure is atmospheric. It is defined by the levels at which water stands in wells that penetrate the water body just far enough to hold standing water. In wells which penetrate to greater depths, the water level will stand above or below the water table if an upward or downward component of groundwater flow exists. For purposes of 310 CMR 43.00, unless otherwise stated, the elevation of the water table shall be taken to refer to its seasonal high level, which generally occurs in late winter or early spring.

Zone I means the protective radius required around a public supply well or well field.

Zone II means that area of an aquifer which contributes water to a well under the most severe recharge and pumping conditions that can be realistically anticipated (*i.e.*, pumping at the approved safe yield of the well for 180 days without any natural recharge occurring); it is bounded by the groundwater divides which result from pumping the well and by contact of the edge of the aquifer with less permeable materials such as till and bedrock. In some locations, streams and lakes may form recharge boundaries. The Zone II shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a ground water flow divide, a contact with till or bedrock or a recharge boundary.) For the purposes of 310 CMR 43.00, a Zone II area is one which has been defined and delineated in accordance with the Department's Division of Water Supply *Guidelines and Policies for Public Water Systems*, November 1993 Addendum to the October 1991 edition or the most recent version thereof.

Zone III means that land area beyond the area of a Zone II from which surface water and groundwater drain into a Zone II. The surface drainage area as determined by the topography is commonly coincident with the groundwater drainage area and will be used to delineate the Zone III. In some locations, where surface and groundwater drainage are not coincident, the Zone III shall consist of both the surface drainage and the groundwater drainage area.

Zone of Contribution means the land area which provides recharge to the well.

43.03: Applicability.

The requirements of 310 CMR 43.01 through 43.09 applies to the selection of a superior site for a low-level radioactive waste facility in accordance with M.G.L. c. 111H.

(43.04 through 43.09: Reserved)

43.10: Modeling Capability

(1) Exclusion Criteria. Exclude sites not capable of being adequately modeled, characterized, analyzed and monitored with respect to hydrogeology, geologic features and ground water flow characteristics as reasonably necessary to demonstrate compliance with DPH performance objectives and those provisions of applicable state and federal regulations governing environmental monitoring.

(2) Conditional Consideration Criteria.

Bedrock Structure. Consider sites containing bedrock structural features and lithologies that may provide significant pathways for groundwater flow or present very complex hydrologic conditions on compliance with 310 CMR 43.40(3).

(3) Preference Criteria. Prefer sites that can be modeled and characterized with a greater degree of certainty, over sites which can be characterized with a lesser degree of certainty.

(43.11 through 43.19: Reserved)

43.20: Groundwater Drinking Supplies and Resource Protection

(1) Exclusion Criteria.

(a) Existing Public Water Systems Pumping More Than 100,000 Gallons per Day. Exclude sites located within the Zone III of an existing public water supply with a maximum approved pump rate of 100,000 gallons per day (gpd) or more.

(b) Existing Public Water Systems. Exclude sites located within the Zone II of an existing public water supply.

(c) Potential Productive Aquifer. Exclude sites located over a potential productive aquifer (PPA) which has been determined by the Department to be qualified for development as a public drinking water system prior to the issuance of the draft candidate site identification report pursuant to M.G.L. c. 111H, § 20(c). Notwithstanding this exclusion, a site may be located within a PPA qualified for development where the site is proposed to be located outside of the Zone II of any system and outside of the Zone III for systems pumping 100,000 gpd or more.

(d) Existing Private Ground Water Source or Non Community Water System. Exclude sites located within the Zone of Contribution of an existing private groundwater source or non-community system unless the source/system is located on the parcel of land that is designated to be acquired pursuant to M.G.L. c. 111H, § 23(g) and the source/system is secured from any use other than uses related to the construction, operation or environmental monitoring of the facility.

(e) Potential Private Groundwater Source or Non-Community Water System. Exclude sites located within the projected Zone of Contribution of a potential private groundwater source or non-community water system unless the source/system is located on the parcel of land to be acquired pursuant to M.G.L. c. 111H, § 23(g) and is secured from any use other than uses related to the construction, operation or environmental monitoring of the facility.

(f) Sole Source Aquifer. Exclude sites which are located over the areal extent of a sole source aquifer.

(g) Minimum Depth to Water Table. Exclude sites where the minimum depth to the water table is insufficient to prevent the intrusion of groundwater, perennial or otherwise, into the waste.

(h) Minimum Depth and Overburden to Bedrock Water Table. Exclude sites where the water table is below the bedrock surface and where between the bedrock and the bottom of the waste management unit there is less than a minimum total thickness of ten feet of (unsaturated) soil units (natural or placed) with a maximum saturated hydraulic conductivity of 1x10(-4) cm/sec.

(i) Maximum Horizontal Gradient. Exclude sites where the average horizontal gradient in the uppermost aquifer underlying the site is more than 0.01.

(2) Conditional Consideration Criteria.

(a) Depth to Water Table. Consider sites where the minimum depth to the water table is ten feet or less from the ground surface or from the bottom of the waste management area, if the waste management area is below the ground surface, on compliance with 310 CMR 43.40(3).

(b) Horizontal Gradient. Consider sites where the average horizontal gradient in the uppermost aquifer underlying the site is 0.01. to 0.005 on compliance with 310 CMR 43.40(3).

(c) Below Bedrock Water Table. Consider sites where the water table extends below the bedrock surface on compliance with 310 CMR 43.40(3).

(3) Preference Criteria.

(a) Horizontal Gradient. Prefer sites with a lower average hydraulic gradient in the uppermost aquifer underlying the site, over sites with a higher average hydraulic gradient in the uppermost aquifer underlying the site.

(b) Depth to Water Table. Prefer sites with greater minimum depths to the water table below the ground surface, over sites with lesser minimum depths to the water table below the ground surface.

(c) Hydraulic Conductivity. Prefer sites with an average hydraulic conductivity in the saturated soil of 1x10-(4) cm/sec. or less, over sites with an average hydraulic conductivity in the saturated soil of greater than 1x10-(4) cm/sec.

(d) Groundwater Travel Time. Prefer sites with a predicted longer average travel time of ground water beneath the waste management area, over sites with a shorter predicted average travel time of ground water beneath the waste management area.

43.21: Surface Water Drinking Supplies and Resource Protection

(1) Exclusion Criteria.

(a) Class A Water Supplies. Exclude any site where the probable waste management area would be located within the watershed of a Class A public surface drinking water supply as defined in 314 CMR 4.05(3)(a).

(b) Class B Public Drinking Water Supplies. Exclude any site where the probable waste management area will be located within any of the following area of a Class B public surface drinking water supply as defined in 314 CMR 4.05(3)(b): 400 feet from the 100 year flood plain elevation extending ½ mile upgradient from the supply intake and extending 200 feet downgradient from the supply intake or to the physical spillway, whichever downgradient distance is less.

(c) Flood Plain, 100 year. Exclude any site in which the probable waste management area would be within any 100 year flood plain.

(d) Wetlands. Exclude sites where the probable waste management area would be located within 100 feet of a resource area protected by the Wetlands Protection Act, M.G.L. c.131, § 40 and 310 CMR 10.00.

(e) Poor Draining Areas. Exclude from the site any land that does not drain well and is subject to periodic flooding or frequent ponding.

(f) Runoff Retention. Exclude from the site upland drainage areas which, due to their size, geometry, and surface characteristics, are unable by natural drainage patterns and normal engineering drainage controls to reliably channel the surface runoff expected from a statistical 100 year precipitation event without significantly eroding or inundating the probable waste management area.

(g) Coastal High Hazard Zones. Exclude sites in coastal high hazard zones.

(h) Dams. Exclude sites in areas subject to inundation by the failure of an existing dam.

(i) Surface Water Discharges. Exclude sites in which a hydrogeologic unit within the probable waste management area discharges groundwater to the surface within the site.

(2) Conditional Consideration Criteria.

(a) 500 Year Floodplain. Consider sites in which the probable waste management area would be located inside any 500 year flood plain on compliance with the provisions of 310 CMR 43.40(3).

43.21: continued

(3) Preference Criteria.

(a) Minimizing Impact to Water Resources.

1. Prefer sites with a lower potential for radioactive substances to impact tributaries and surface water bodies resulting in harm to human, animal or aquatic life or the most sensitive designated use, over sites with a higher potential for such impact.

2. Prefer sites with a lower potential for radioactive substances to impact tributaries or surface water bodies resulting in radionuclides in aquatic life exceeding the recommended limits for consumption by humans, over sites with a higher potential for such impact.

3. Prefer sites with a lower potential for radioactive substances to impact tributaries or surface water bodies resulting in exceeding Massachusetts drinking water standards, 310 CMR 22.09, over sites with a higher potential for such an impact.

(b) Distance from Environmentally Sensitive Surface Waters. Prefer sites further away from intakes and tributaries of free flowing surface water supplies, lakes, rivers not including intermittent streams, outstanding resource waters and resource areas protected by the Wetlands Protection Act (M.G.L. c. 131, § 40), over sites closer to such surface waters.

43.22: Tectonic Processes

(1) Exclusion Criteria.

Tectonic Processes. Exclude sites where tectonic processes in the vicinity, such as faulting, folding, seismic activity or volcanism are reasonably likely to adversely affect the ability of the probable waste management area to meet DPH performance objectives or preclude adequate modeling and prediction of long term impacts.

(2) Preference Criteria.

(a) Earthquake History. Prefer sites further away than three miles from the epicenter of an earthquake which occurred within the last 300 years and which would measure four or more on the Richter magnitude or equivalent scale or Modified Mercalli Intensity V, over sites which are closer to such epicenter.

(b) Minimizing Potential Tectonic Effects. Prefer sites with a lower potential for adverse effects from local or regional tectonic activity, over sites with a higher potential.

43.23: Surface Geologic Processes

(1) Exclusion Criteria.

(a) Surface Geologic Process. Exclude sites where the probable waste management area would be located in the vicinity of surface geologic processes such as mass wasting, erosion, slumping, landsliding, which occur with such frequency and extent that such events would be reasonably likely to adversely affect the ability of the site to meet any DPH performance objectives or preclude adequate modeling and prediction of long term impacts.

(b) Slope. Exclude sites where the probable waste management area would have an average slope greater than 20%.

(2) Conditional Consideration Criteria.

(a) Contaminant Migration. Consider sites with surficial deposits unlikely to substantially retard groundwater flow and radionuclide migration beneath the facility on compliance with 310 CMR 43.40(3).

(b) Seismic Impact Zone. Consider sites located in a seismic impact zone on the condition that it can be reasonably demonstrated that the engineered structures, systems and components important to waste isolation and release containment functions of suitable facilities are sufficiently capable of resisting the maximum horizontal acceleration in lithified earth material to prevent a release of radiation which results in a dose exposure in excess of DPH performance objectives.

(3) Preference Criteria.

(a) Liquefaction Performance Standard. Prefer sites with less potential to subject the probable waste management area to potential liquefaction, over sites with greater potential for liquefaction.

(b) Soil Stability. Prefer sites that provide a more stable foundation for engineered containment structures, over sites with a less stable foundation.

(c) Subsurface Dissolution. Prefer sites that demonstrate less significant past or active dissolution, over sites which demonstrate more dissolution.

(d) Overburden Deposition Process. Prefer sites where the overburden is composed of lesser amounts of varved clay or holocene lacustrine deposits, over sites with greater amounts of such materials. Prefer sites in which the overburden is composed of greater amounts of glacial till, over sites with lesser amounts of till.

(e) Overburden Composition and Depth. Prefer sites with thicker unconsolidated units and with a higher clay or silt content, over sites with thinner units or lower clay/silt content for facilities located above the ground or near to the surface.

(f) Seismic Impact Zone. Prefer sites that have a lower predicted maximum horizontal ground acceleration, expressed as a percentage of the earth gravitation pull (percent g), over sites with a higher percent g.

(g) Complexity and Uniformity. Prefer sites that have a less complex tectonic history and geologic structure, over sites that have a more complex tectonic history and geologic structure.

(h) Retarding Migration. Prefer sites where natural characteristics, including but not limited to the permeability and the sorptive potential of the subsurface materials, provide greater potential to retard the movement of radionuclides, over sites with less retardation capability.

(i) Erosion. Prefer sites exhibiting less potential erosion characteristics, over sites exhibiting greater potential erosion characteristics.

43.24: Demography

(1) Exclusion Criteria.

(a) Effect on Facility Performance. Exclude sites where the existing population density, projected population growth or future development in the vicinity of the site is reasonably likely to interfere with the ability of the facility to meet DPH performance objectives.

(b) Proximity to Sensitive Population Locations. Exclude sites where the probable waste management area would be located in proximity to sensitive population locations as a result of which:

1. It is reasonably likely that the site will not be able to meet the DPH performance objectives; or

2. The exposure to radiation or toxic materials, if mixed waste is to be accepted at the site, which a member of the affected sensitive population is reasonably likely to receive in the event of a release of radiation or hazardous waste from the site would result in a significantly higher than normal risk of adverse effect on the health of the sensitive population.

(2) Conditional Consideration Criteria.

(a) Proximity to Residences. Consider sites where, due to the proximity of the probable waste management area to residences, it is reasonably likely that the site will not be able to meet the DPH performance objectives on the condition that the land on which the residences are located is acquired and no further residential use of said land is permitted for such period of time as said performance objectives have a reasonable likelihood to be exceeded.

(b) Proximity to Population Centers. Consider sites where the probable waste management area would be within 1½ miles of the property limits of an urban area zoned to exclude industrial and commercial development on compliance with the provisions of 310 CMR 43.40(3).

(c) Proximity to Sensitive Population Location. Consider sites where the distance from the edge of the probable buffer zone to a sensitive population location is within ¼ of a mile on compliance with the provisions of 310 CMR 43.40(3).

43.24: continued

(3) Preference Criteria.

(a) General Population Density. Prefer sites located in areas of lower population density, over sites located in areas of higher population density.

(b) General and Sensitive Populations. Prefer sites that are projected to release less radiation to the public and environment over sites that are projected to release radiation at higher levels.

(c) Population Growth. Prefer sites located where significant development or population growth is less likely to occur in surrounding areas, over sites located where development or population growth is more likely to occur in surrounding areas.

(d) Transient Populations. Prefer sites located in areas where smaller increases in transient population density occur on a regular basis, over sites located in areas subject to greater transient population increases.

43.25: Site Size and Facility Compatibility

(1) Exclusion Criteria.

(a) DPH Regulations. Exclude sites that are insufficient in size to contain a waste management area, a buffer zone and other facility components.

(b) Management Board Determination. Exclude sites that are insufficient in size to meet the minimum land areas determined by the Board to be required for suitable facilities.

(2) Preference Criteria.

Compatibility. Prefer sites with characteristics most compatible with suitable facilities, over less compatible sites.

43.26: Compliance with Department of Public Health Performance Objectives

Exclusion Criteria. Exclude sites which are not reasonably likely to meet DPH performance objectives based on a performance assessment that, at a minimum, incorporates the facility design standards of probable suitable technologies set forth at 105 CMR 120.815.

43.27: Meteorology and Climatology

Preference Criteria.

Weather Patterns. Prefer sites which are less likely to be subject to climatic and meteorological conditions which would adversely affect the ability of the site to meet DPH performance objectives over sites which are more likely to be subject to adverse weather conditions.

43.28: Transportation.

(1) Conditional Consideration Criteria.

(a) Quality of Mode. Consider sites that are not serviced by highways or rail lines that meet applicable state and federal low-level radioactive waste transportation laws and regulations on condition that the mode to be used for delivery of waste to the site is able to be constructed or otherwise upgraded to come into compliance with said laws or regulations prior to construction of the facility.

(b) Accidents and Congestion. Consider sites that are not serviced by sufficiently safe or uncongested highways or rail lines on the condition that the mode to be used for delivery of waste to the site is able to be constructed or otherwise upgraded to achieve reductions to a level of safety and lack of congestion necessary to adequately protect the public health and safety prior to construction of the facility.

43.28: continued

(2) Preference Criteria.

(a) Distance from Major Routes. Prefer sites at shorter distances from the interstate highway system, other multi-lane, limited access roadways or existing rail lines, over sites at greater distances from such transportation routes.

(b) Congestion. Prefer sites served by routes which are not currently congested, over more congested routes.

(c) Multiple Modes. Prefer sites that are accessible by more modes of transportation, over sites with fewer available modes.

(d) Housing Density. Prefer sites that have primary access routes from the interstate highway system, other than multi-laned limited access roadways or exisiting rail lines, with a lower average number of residential dwellings per route mile, over sites having primary access roads with a higher average number of dwellings per route mile.

(e) Public Places Density. Prefer sites where the primary access routes to the facility from the entrance of an interstate or limited access highway has fewer public facilities such as schools, parks, or hospitals, over sites where the primary access roads abut more such facilities.

(f) Accident Rates. Prefer sites for which the access routes exhibit lower accident rates as measured by the actual number of accidents, resulting property damage, and lives lost over sites with higher accident rates.

43.29: General Land Use

(1) Exclusion Criteria.

(a) Incompatible Nearby Activities. Exclude sites where the probable location of the waste management area in relation to nearby activities is reasonably likely to adversely affect the ability of the site to meet DPH performance objectives.

(b) Interference with Monitoring. Exclude sites where the probable location of the waste management area in relation to nearby past or present activities is reasonably likely to significantly impair the environmental monitoring program including, without limitation, existing or past activities or natural sources that emit radioactivity or release non- radioactive material into the environment to the extent that it is reasonably likely to adversely affect the ability of the environmental monitoring program to detect or monitor the existence or magnitude of emissions or releases from the facility or the site.

(c) Agricultural Land. Exclude sites located on prime agricultural land based on soil classification established by the U.S. Soil Conservation Services or on land designated as an agricultural incentive area pursuant to M.G.L. c. 40L, § 1 *et seq.* on or before December 31, 1992.

(d) Acquisition Potential. Exclude sites to which the Commonwealth cannot obtain title.

(2) Conditional Consideration Criteria.

Resource Exploitation. Consider sites which contain economically recoverable resources on the condition that the exploitation is reasonably likely not to adversely affect the ability of the site to meet DPH performance standards or significantly impair the environmental monitoring program.

(3) Preference Criteria.

(a) Incompatible Development. Prefer sites located farther away from areas where incompatible development is imminent, over sites in close proximity to areas subject to imminent development.

(b) Upstream Land Alterations. Prefer sites located in areas having less upstream land available for future development, over areas having more land upstream of the site which is suitable for development.

(c) Subsurface Exploitation. Prefer sites that contain areas which have undergone lesser subsurface resource exploitation, over sites which contain areas subjected to greater subsurface resource exploitation.

(d) Resource Exploitation. Prefer sites with less economically recoverable resource potential, over sites with greater resource exploitation potential.

(e) Local Planning and Zoning. Prefer sites at which a facility would be more compatible with existing local zoning restrictions or local or regional plans, over sites at which a facility would be less compatible with such restrictions or plans.

(f) State Land. Prefer land owned by the Commonwealth that has not been excluded from consideration by other criteria, over land owned by other public or private parties.

43.30: Air Quality

Preference Criteria.

Adverse Impact Potential. Prefer sites which have a lower potential for emissions from the construction or operation of a facility, over sites which have a higher potential to cause adverse impacts to air quality.

43.31: Protected Lands, Species and Resources

(1) Exclusion Criteria.

(a) Areas of Critical Environmental Concern. Exclude sites located in any area of critical environmental concern designated pursuant to M.G.L. c. 21A, § 2(7), St. 1974, c. 808, § 401(e) and 301 CMR 11.15.

(b) Scenic Rivers and Streams. Exclude sites located in scenic and recreational rivers and streams of the commonwealth" designated pursuant to 302 CMR 3.00;

(c) Federally Protected Resources. Exclude sites that are reasonably likely to adversely affect any national park, monument, lake shore, habitat of endangered species, or area protected by the Wilderness Act, 16 USC §§ 1131-1136, the Wild and Scenic Rivers Act, 16 USC §§ 1771-1287, and the Fish and Wildlife Coordination Act, USC §§ 661-666c; or the National Historic Preservation Act, 16 USC §§ 470-470m.

(2) Conditional Consideration Criteria.

(a) Consider sites located on any lands or resources which have been taken by the General Court pursuant to its authority set forth in Article 97 of the Constitution of Massachusetts, as amended prior to the date on which the Board affirmatively votes to initiate site selection pursuant to M.G.L. c. 111H, § 17, on the condition that, prior to the construction of the facility, a law is enacted by a ⅔ vote, taken by yeas and nays, of each branch of the General Court, allowing such land or resource to be used for such purpose.

(b) Consider sites located on protected areas provided that the area is not excluded under 310 CMR 43.31(1) and further provided that prior to the construction of the facility:

1. the laws or regulations establishing or controlling activities in protected areas do not expressly or by necessary implication preclude the siting of a low-level radioactive management facility; and

2. all applicable conditions contained in said laws or regulations that would continue to be applicable to the site if it were acquired pursuant to M.G.L. c. 111H, § 23(g) are satisfied; and

3. all applicable permits, licenses, approvals, notifications or waivers required for a facility on state-owned land are obtained.

(c) Consider sites located in proximity to protected areas on the condition that locating a facility in proximity to the protected area is not reasonably likely to adversely affect the protected area.

(3) Preference Criteria.

(a) Adverse Impacts. Prefer sites which are less likely to have an adverse effect on a protected area over sites which are more likely to have an adverse effect.

(43.32 through 43.39: Reserved)

43.40: Application of Criteria Categories

(1) General. There are three criteria categories under which a site characteristic may be evaluated: exclusion, conditional consideration and preference. A site characteristic may be included under more than one category in which case it is evaluated based upon the standards of review set forth at 310 CMR 43.40(2) through (4).

(2) Exclusion. An exclusion characteristic eliminates a site from further consideration. A superior site may not exhibit an exclusion characteristic.

(3) Conditional Consideration. A conditional consideration characteristic does not necessarily eliminate a site from consideration. A superior site may exhibit a conditional consideration characteristic where the site meets the conditions applicable to the criterion as follows:

(a) The standards and/or modification required as a pre-condition for consideration of the site either are able to be satisfied at the time of site selection or are determined at the time of site selection to be reasonably likely to be able to be satisfied before facility construction commences; or

(b) A site specific analysis demonstrates that the potential adverse effect of off-site migration or of pubic exposure to radioactivity which the criterion was intended to protect against will not reasonably affect the ability of the site to meet DPH performance objectives or that the criterion is inapplicable to the waste isolation capability of the site or the facility.

(4) Preference. A site exhibiting a preference characteristic is advantageous in that aspect as compared to a site which does not exhibit the preferred aspect. A site exhibiting a greater degree of a preferred characteristic is more advantageous in that aspect as compared to a site exhibiting less of the characteristic.

(5) Additional Preference Criteria. The listing of the preference criteria in 310 CMR 43.10 through 43.39 is not intended to prohibit the Board from applying additional preference criteria in accordance with the provisions of M.G.L. c. 111H provided that such criteria do not contravene the criteria contained in 310 CMR 43.00.

(5) Scaling Preference Criteria and Objectives. In order to assist in evaluating and comparing potential sites the Board may develop scaling methods that rank or weight preference criteria by, for example, assigning numerical or other quantitative or qualitative values to measure the relative degrees of importance among the different criteria and to measure the extent to which a particular site satisfies a specific criterion. If the Board determines to apply any method to compare among preference criteria the Board shall adopt said method prior to the issuance of the draft candidate site report and in accordance with the provisions in M.G.L. c. 111H. Nothing herein shall require the Board to base a site selection decision on a comparison of the relative advantages or disadvantages of preference criteria exhibited among technically superior sites.

43.41: Requirements for a Technically Superior Site

(1) A site shall be considered to meet the minimum qualifications to be selected as a superior site if, after detailed site characterization conducted in accordance with 310 CMR 43.00 and the applicable provisions of M.G.L. c. 111H, it satisfies all of the following requirements:

(a) The site does not exhibit any exclusion criterion;

(b) The site does not exhibit any conditional criterion unless the requirements set forth at 310 CMR 43.40(3) are satisfied; and

(c) A performance assessment conducted in accordance with protocols approved by the Department of Public Health, or other applicable state or federal regulatory agency having jurisdiction over the licensing of a facility at the site demonstrates that the site will meet DPH performance objectives.

(2) The Board shall comply with the provisions set forth in 310 CMR 43.41 through 43.43 in the selection of a superior site provided that nothing herein is intended to prevent the Board from adopting standards that are intended to provide additional protection of the public health, safety and the environment or adopt procedures that supplement the data analysis or quality assurance procedures set forth herein.

(3) The provisions set forth in 310 CMR 43.44 through 43.72 are intended as recommended guidance for the Board in regard to the collection and analysis of data. No failure to comply with 310 CMR 43.44 through 43.72 shall be deemed a basis for the Department to disapprove the Board's selection of a superior site pursuant to these regulations unless such failure:

43.43: continued

(a) constitutes a significant violation of a provision of any regulations of the Department or the Department of Public Health referenced in 310 CMR 43.00 in effect at the time the violation occurred; or

(b) precludes a finding, based on substantial evidence, that the site satisfies the requirements of 310 CMR 43.43.

43.42: General Guidance in Site Selection and Characterization Methodology

(1) Except as may be otherwise expressly provided in M.G.L. c. 111H or 310 CMR 43.00 the Board should apply the standards, protocols, and procedures set forth in the most recent applicable guidance documents on low-level radioactive waste management facility site selection and characterization issued by or under the authority of the Nuclear Regulatory Commission [NRC], the Department of Energy, the Environmental Protection Agency or the Department of Public Health.

(2) Notwithstanding the provision of 310 CMR 43.42(1)(a), the Board may choose not to apply any standard, protocol or procedure as set forth in the federal documents (federal measure) described in said subsection provided the Board makes a finding and documents that:

(a) the federal measure is not applicable to a site or waste management technology under consideration due to conditions particular to Massachusetts or the site and substitute measures will provide accurate and verifiable data necessary to determine that a superior site meets the requirements of 310 CMR 43.41; or

(b) a standard, protocol, or procedure proposed as a substitute for the federal measure will provide accurate and verifiable data which is equivalent or superior to the data or analysis intended to be provided by the federal measure.

(3) Data shall be collected, analyzed and applied in accordance with generally accepted practices in the fields of geology, soil science and soil engineering, hydrology, land use studies, transportation, meteorology, environmental engineering, civil engineering, performance assessment, air modeling and monitoring and such other related disciplines as are necessary to a select a superior site. The Board shall apply the written guidance, protocols and procedures established by the Department for the investigation, characterization and modeling of water resources, wetlands and air quality except where the provisions of said documents contravene a Nuclear Regulatory Commission regulation in which case the NRC regulation shall govern.

(4) Except as otherwise provided in applicable state or federal regulations, where site compliance with a criterion is based upon its ability to meet DPH performance objectives or to avoid or minimize an adverse effect and it is accepted professional custom or practice to utilize assumptions or estimate probabilities in conducting an evaluation to determine a site characteristic or parameter, the Board shall at a minimum apply reasonable but conservative assumptions and probabilities to assess the site's performance and compliance. In applying the reasonably likely standard contained in the criteria the Board shall adopt reasonable but conservative confidence limits for statistically defined measures. Where compliance with a performance standard is evaluated, the evaluation may consider the performance of the waste containers and the facility in isolating the waste from the environment. In evaluating the long term waste isolation capability of the containers and the facility the Board shall incorporate design and performance requirements set forth in applicable federal and state laws and regulations including, without limitation 105 CMR 120.800.

(5) In determining whether or not a site meets a criterion which is based upon the site achieving a certain level of performance or compliance with DPH performance objectives, the Board may, in the preliminary screening phases set forth herein, adopt reasonable factors to eliminate, or set aside for later possible consideration, areas that the Board does not believe are likely to meet the criterion including, without limitation, minimum distances from the site or the waste management area to potential human or environmental receptors.

(6) If at any time during the course of the site selection process the chief executive officer of a municipality requests that the Board consider the suitability of land within the municipality's jurisdiction, the Board may at its discretion advance the assessment of the volunteered location(s) and defer or delay evaluation of other sites as it deems appropriate.

(7) If at any time during the course of evaluation of a particular site a determination is made that the site will not meet an exclusion or conditional consideration criterion the Board may terminate or suspend further evaluation of the site as it deems appropriate.

(8) The Board shall employ the Massachusetts Geographic Information System [GIS] or, at a minimum, an equivalent computerized mapping system in the evaluation and presentation of mappable data.

(9) The Board shall employ other relevant mapped or tabular data which is publicly available and obtained from its own investigation but may not be currently maintained within the GIS (*e.g.*, U.S. Geological Survey geologic maps and seismic, flood plain, soil and land conservation maps). The Board should make reasonable efforts to incorporate said data layers into the GIS commensurate with the applicable stage of site screening.

(10) Notwithstanding the provision of 310 CMR 43.45, 43.51 and 43.61, where during any preliminary stage of site characterization it is infeasible for a site characteristic to be adequately evaluated to determine if the site should be screened out, the Board may continue to collect data on and analyze the site in order to make the screening decision at a later stage of site characterization.

43.43: General Guidance in Quality Assurance

(1) At each stage of the site evaluation process the Board shall develop and implement a quality assurance [QA] program designed to ensure data reliability, validity, traceability, retrievability, completeness and technical accuracy. The requirements set forth at 310 CMR 43.42(1) and (2) regarding the application of Nuclear Regulatory Commission and Department of Energy guidance, shall also apply to development and implementation of a quality assurance program. The scope of the quality assurance program shall be commensurate with the type of data being collected, the scope of the data collection and the analysis required by the Act and the regulations at each respective stage of the site screening process (4.63).

(2) The analytical map work performed in the course of site selection shall be conducted by qualified professionals experienced in the use of the GIS, or equivalent system if applicable, and knowledgeable in the field of cartography. The collection and analysis of data performed in support of the site screening and site characterization required shall be conducted by qualified professionals experienced in the respective fields of geology, soil science and soil engineering, hydrology, land use studies, transportation, meteorology environmental engineering, civil engineering, performance assessment, air modeling and monitoring and such other related disciplines as are necessary to select a superior site. All field mapping and surveying shall be conducted by a registered surveyor.

(3) The GIS and map work performed shall be done in substantial accordance with professional standards or generally accepted protocols and uniform procedures for the collection, analysis and presentation of mappable data. A detailed procedure for digitizing map data shall be developed to assure uniform performance and documentation of digitizing activities. Software quality assurance plans shall be developed and implemented to control verification and validation of the software packages being utilized for GIS or equivalent activities. Where data are entered into the GIS or equivalent system after the decision to initiate site selection, the Board shall ensure that records be maintained that, at a minimum, contain the name of person entering the data, the type and source of the data and the date the data were entered.

(4) Records of qualifications should be obtained for all persons employed in data gathering and analysis, and said statements of qualifications should be maintained in the Board's files.

43.44: Application Guidelines and Procedures for Use in Preparation of the Statewide Mapping and Screening Report

(1) Objective. The objective of the Statewide Mapping and Screening Report required to be issued under Section 20 of the Act is to exclude at the outset of the site selection process any areas of the Commonwealth that are obviously unable to satisfy the site selection criteria contained in 310 CMR 43.00. The purpose of 310 CMR 43.44 is to provide guidance on how, at a minimum, the requirements for a technically superior site pursuant to 310 CMR 43.41 are to be interpreted and applied for the purposes of this report.

(2) Date Collection and Evaluation.

(a) The Statewide Mapping and Screening Report should identify those locations the Board determines are obviously unsuitable as a superior site. The Statewide Mapping and Screening Report should be prepared on the basis of data reasonably available on the date the Board votes to initiate site selection, pursuant to M.G.L. c. 111H, § 17 , as may be obtained from public agencies, private not-for-profit land conservation associations and the published open literature.

(b) Lack of uniform coverage of the Commonwealth with respect to certain data should not be a cause to fail to use data that are available.

(c) The data collection and presentation should be limited to factors relevant to the exclusion criteria. The factors to be applied may reflect land areas that are of sufficient size and extent to be mapped on a statewide basis.

(d) The specific mapping accuracy should be commensurate with the map scales employed and the accuracy of the data sets. As a general matter the scale of the map should be consistent with the scale at which the data were entered. The map scales employed should be in the range of 1:100,000 to 1:250,000.

(e) The Board shall not be responsible to verify the accuracy of data provided by federal and state agencies but it should identify the sources of all the data and discuss the estimated quality of data and the sensitivity of the results to data uncertainty and data gaps. The Board should specify that the boundaries of included areas are defined with an accuracy that is commensurate with the map scales and data sets used and may be subject to revision on the basis of more detailed characterization.

43.45: Specific Guidance for the Application of Particular Conditions

(1) General. 310 CMR 43.45 provides guidance on the application of particular conditions as part of the preparation of the Statewide Mapping and Screening Report.

(2) Modeling Capability-43.10. Hydrogeologic units containing faults, deeply weathered bedrock, buried river channels and sand lenses if capable of delineation at this stage should be screened out.

(3) Large Existing Community Water Systems-43.20(1)(a). In determining the Zone III of the supply, the drainage sub-basin of the area in which the well is located shall be delineated and screened out.

(4) Existing Community Water Systems-43.20(1)(b) and 2(a). In the absence of approved delineated Zone IIs, sites within the Interim Wellhead Protection Area [IWPA] of public water supplies shall be delineated and screened out.

(5) Potential Productive Aquifers-43.20(1)(c). The Board may choose to screen out sites located over potential productive aquifers without considering the likelihood that they will be determined to be qualified for development.

(6) Class A Public Drinking Water Supplies-43.21(1)(a). In determining the watershed of an impounded surface water supply the drainage sub-basin of the supply shall be delineated and screened out.

(7) 100 Year Flood Plains 43.21(1)(c). The evaluation of flood plains should be determined by reference to the most recently available flood profile data prepared under the National Flood Insurance Program (NFIP), currently administered by the Federal Emergency Management Agency. The boundary, as determined, shall be presumed accurate. This presumption may be overcome only by reliable evidence from a registered professional engineer or other professional competent in such matters.

(7) Coastal High Hazard Zones 43.21(1)(g). In determining the coastal high hazard zones the coastal areas within the 100 year flood plain as delineated in the most recently available profile data prepared under the NFIP and all barrier beaches should be delineated and screened out.

(8) Dams-43.21(1)(f). Sites located in an area which would be affected by the failure of a dam with a Hazard Classification Class I or Class II, as determined in accordance with 302 CMR 10.09(3), which are capable of delineation at this stage should be screened out. The downstream inundation flood zone may be determined on the basis of records maintained by the Dam Safety Division of the Department of Environmental Management.

(9) Interference with Monitoring 43.29(1)(b). Places where National Priority List sites, Resource Conservation and Recovery Act facilities, any locations of releases or sites as defined pursuant to M.G.L. c. 21E and the regulations promulgated thereunder, any solid waste disposal sites as defined pursuant to M.G.L. c. 111, § 150A and the regulations promulgated thereunder or Leaking Underground Storage Tanks as defined in M.G.L. c. 148, § 38B are identified and that are capable of delineation at this stage should be evaluated if there is reason to believe radioactive materials or mixed waste were used or disposed of at those locations. The Board may chose to defer elimination of an area described herein on the basis of further data on the extent to which existing potential contamination of the site will affect the performance of the site and its ability to be adequately monitored.

(43.46 through 43.49: Reserved)

43.50: Application Guidelines and Procedures for Use in Preparation of the Report Identifying Possible Locations

(1) Objective. The objective of the Report Identifying Possible Locations is to identify those areas of the Commonwealth where there is a reasonable likelihood, based on the data available to the Board at the time the report is issued, of identifying one or more sites that will meet the criterion at 310 CMR 43.41(1)(a) and (b).

(2) Data Collection and Evaluation Protocols.

(a) The Report Identifying Possible Locations may be prepared on the basis of data available from any credible public or private source as well as data obtained by the Board on the basis of its own investigation. Such information may include, without limitation, the sources set forth at 310 CMR 43.44, municipal sources, aerial photography, windshield surveys, walkovers or other surficial field investigation to identify apparent exclusion factors not shown on existing maps. Installation of ground water wells is not required.

(b) Exclusion factors which were not applied in the Statewide Mapping and Screening Report because of size consideration, data availability or qualifications or interpretation of regulatory requirements should be applied to the extent those restrictions have been overcome by further investigation by the Board. In addition, conditional consideration criteria should also be evaluated to the extent that data is available and can be analyzed in accordance with the procedures established herein within the time limit established by M.G.L. c. 111H. The Board may include any site as a possible site even though it exhibits a conditional consideration criterion if the Board determines that further characterization of the site is advisable based on the likelihood that the condition will be satisfied upon further characterization.

43.50: continued

(c) Lack of uniform coverage of the State with respect to certain data requirements shall not be a cause to fail to use data that are available provided that the Board should use reasonable efforts to obtain statewide data on criteria which form the basis of a decision to screen out a site. The further specific guidelines of 310 CMR 43.51 shall also be observed.

(d) Although the Report should reflect the data and analysis of only the exclusion and conditional consideration criteria the Board may collect and analyze preference data for future use.

(e) The factors to be applied may reflect land areas that are of sufficient size and extent to be mapped on a statewide or regional basis as deemed appropriate to most accurate delineation. The specific mapping accuracy should be commensurate with the map scales employed and the accuracy of the data sets. As a general matter the scale of the map should be consistent with the scale at which the data was entered. Mapping scales down to 1:24,000 may be utilized.

(f) The Board shall not be responsible to verify the accuracy of data provided through federal and state agencies but it should identify the sources of all the data and discuss the estimated quality of data and the sensitivity of the results to data uncertainty and data gaps. The Board should be responsible to verify through implementation of the quality assurance program all data collected through its own investigation.

43.51: Specific Guidance for the Application of Particular Conditions

(1) General. 310 CMR 43.51 provides guidance on the application of particular conditions as part of the preparation of the Report Identifying Possible Locations.

(2) Potential Productive Aquifer-43.20(1)(c) The Board shall not consider for siting locations within the Zone II or Zone III, as applicable, of future community water systems which have received Department approval as a new source or have submitted the appropriate documentation to the Department for a new source approval in accordance with Department guidelines.

(3) Depth to Water Table-43.20(1)(g). Depth to the water table may be inferred by considering, but not limited to, any of the following: frequency and distribution of wetlands, location of surface water bodies, elevation and topography, soil types and relevant well drillers logs so long as:

(a) the rationale for the method of inference is developed by responsible professionals experienced in the hydrogeology and geology of Massachusetts; and

(b) the rationale is explained in the report.

(4) Distance from Surface Water Supplies-43.21(1)(a) and (b). Upgradient and down-gradient directions for groundwater flow may be inferred from surface topography in the absence of readily available subsurface data.

(5) Site Size-43.25. In applying this condition, consideration should be taken of the substantial variability in natural environments and geologic conditions. The possible locations identified in the subject report must be large enough to allow the evaluation of a range of candidate sites during the subsequent phase of site investigation, including the preparation of the Candidate Site Identification Report. Consideration should also be given to the minimum land area determined by the Board to be required for suitable facilities.

(43.52 through 43.59: Reserved)

(1) Objective. The principal objective of the Candidate Site Identification Report is to identify at least two, but not more than five, candidate sites that have a high likelihood of satisfying the requirements of 310 CMR 43.41(1). In addition, the report is intended to present the results of a preliminary characterization of the meteorology, surface and ground water, geology, tectonics, geomechanics, air quality, ecology, land use, cultural resources and social and economic characteristics of each such candidate site; a description of the procedure used to identify the candidate sites based on such preliminary characterization; and draft plans for detailed site characterization of each candidate site. Installation of ground water wells is not required for sites which are not selected as candidate sites. The purpose of this section is to provide guidance on how, at a minimum, the requirements for technically superior sites should be interpreted and applied in the preparation of this report.

(2) Data Collection and Evaluation Protocols.

(a) The Candidate Site Identification report should be prepared on the basis of the types of data sources described at 310 CMR 43.40 and 43.50, additional published and unpublished data and maps and additional field data obtained and technical analysis carried out during this or previous phases of the siting process.

(b) All exclusion, conditional consideration and, in the Board's discretion, preference criteria should be applied and evaluated in the preparation of the Candidate Site Identification Report.

(c) The Board may continue to use the GIS for data analysis and comparative evaluations of siting factors. Map scales should be employed, if reasonably available, which most accurately depict the characteristic being evaluated. Mapping accuracy should be commensurate with the map scales employed and the accuracy of the data sets.

(d) Computer modeling may be used in the site evaluation process for those factors for which computer models are determined to be reliable and valid in prediction, including, but not limited to, generally accepted performance assessment, hydrogeologic and hydraulic models. It is not required that the computer code be specifically developed for low-level radioactive waste management siting provided the code is applicable to the site/facility and the parameter being investigated. Where a code is not generally accepted a determination of reliability and validity should include, but not be limited to the following factors:

1. The model should have supporting documentation that establishes its ability to represent the factors under investigation and any history of its previous applications;
2. The set of equations representing the factor under investigation must be theoretically proven and must be well documented;
3. The numerical solutions must be based on sound mathematical principles and supported by verification and checking techniques;
4. The model must be calibrated against site specific field data developed in accordance with 310 CMR 43.00; and
5. A sensitivity analysis should be conducted to measure the model's response to changes in the values assigned to major parameters, specified error tolerances and numerically assigned space and time discretizations.

(e) Conceptual model uncertainty should be addressed by identifying a broad range of conceptual models, and using each in performance assessments. Revisions of these models should be made by accounting for progressive data collected that can be used to eliminate some models from consideration. Uncertainties about the future of the site should be addressed by projecting alternative future site conditions. Parameter uncertainty may be addressed by using Monte Carlo analysis in combination with other techniques (such as Latin Hypercube Sampling) to reduce the computation effort.

(f) Despite the efforts to validate models, substantial uncertainties are likely to be encountered in making predictions. Sole reliance on these numerical predictions to determine compliance may not be appropriate; the Board may chose to supplement such predictions with qualitative judgments as well.

(g) Any ground water wells that are installed to collect data and evaluate the extent to which the site meets the criteria for a superior site should be installed and maintained in accordance with Department guidance document, Standard Reference for Monitoring Wells, WSC-31-91.

43.60: continued

(h) In the absence of specific Department policy/guidance documents, the analysis of hydraulic factors necessary to calculate saturated and unsaturated groundwater flow paths including, without limitation, horizontal gradient, hydraulic conductivity, transmissivity, hydraulic head, porosity, geometry, boundary conditions and the time of travel of the flow shall be conducted in accordance with generally accepted standards, principles and protocols, including, without limitation, a pump test performed in accordance with generally accepted methods, if appropriate. Where an evaluation of these parameters is dependent upon measurement of soil or water samples the measurement may be done by direct measurement in situ or by the testing of laboratory samples. The use of both methods is highly desirable,but more extensive investigations may be deferred to the Detailed Site Characterization stage.

(i) The site characterization activities should be consistent with the guidance set forth at 310 CMR 43.42(1) to the extent that the detail set forth in said guidance is consistent with and applicable to the scope of a site investigation necessary to conduct a valid preliminary site characterization. The Board should indicate in its report where further site characterizations are to be deferred to the Detailed Site Characterization stage. In addition to these guidelines the further guidelines of 310 CMR 43.61 and 43.62 should be applied.

(j) Where the Board determines that adequate data exists and/or reasonable assumptions can be made on site characteristics, waste characterization and probable facility design, a preliminary performance assessment on likely sites may be conducted. The purpose of the assessments is to assist in the evaluation of how the site will perform by itself and in conjunction with suitable technologies to meet DPH performance objectives. The preliminary performance assessments should be used to estimate factors including, but not limited to:

1. The potential release of radioactivity from waste packages into the facility;
2. The potential release of radioactivity through the engineered barriers into the ambient or geologic environment;
3. The movement of radioactive materials through the environment to humans by ingestion or direct contact;
4. The resulting exposure to humans in comparison to DPH performance objectives and among the sites.

(k) Performance assessments need not provide complete assurance that DPH performance objectives will be met. Because of the long time periods which may be involved and the nature of the events and processes of interest, there will inevitably be substantial uncertainties in projecting site and facility performance. What is required is a reasonable expectation based on reasonably conservative assumptions in relation to the record before the Board that compliance with DPH dose performance objectives is reasonably likely to be achieved.

43.61: Specific Guidance for the Application of Particular Conditions

(1) General. 310 CMR 43.61 provides guidance on the application of particular conditions as part of the preparation of the Candidate Site Information Report.

(2) Modeling Capability-43.10.

(a) The depth to bedrock and the types of soils at the surface and in the subsurface should be determined according to accepted methods and principles. Hydrogeologic units should be delineated and the direction and rate of groundwater movement should be estimated on the basis of field data and quantitative models. Hydraulic conductivities should be estimated on the basis of lithologic classifications and direct measurement. Other characteristics, such as ground water discharge points, water table fluctuation, moisture potential, moisture content, hydraulic conductivity, porosity, geometry, boundary conditions and the physical and chemical properties of the water should be evaluated on the basis of field surveys or available data. The evaluation should also consider the results of hydrogeologic modeling. In evaluating this criterion the following factors should, at a minimum, be reviewed:

1. The presence and extent of permeable and impermeable anomalies, variability and complexity in the stratigraphic relationships and lithology of the site, including, but not limited to, significantly fractured bedrock, faults, or sand/gravel lenses/layers or buried river channels, which would complicate monitoring.

2. The extent to which the lateral flow of groundwater can be confidently predicted to flow to a defined discharge point rather than to multiple surface water bodies or down through bedrock;

3. The ability of the site to be adequately described with a reasonable number of monitoring points;

4. The presence or absence of upgradient, potentially leachable radioactive material.

(b) The feasibility of monitoring for the release of radionuclides via groundwater pathways should be analyzed. In evaluating the feasibility of monitoring the Board should consider, at a minimum, the amenability of the site to modeling by available and applicable computer codes including, without limitation, the ability to reproduce natural and steady state conditions in response to precipitation and pumping stresses.

(3) Existing Public Water Systems-43.20(1)(b) and (2)(a). A conceptual Zone II of all existing public systems within 15,000 feet upgradient of the site, which do not have Department approved Zone IIs, should be calculated in accordance with Department approved procedures.

(4) Potential Productive Aquifer-43.20(1)(c). Except as otherwise provided in regulations or written policy adopted by the Department subsequent to the effective date of 310 CMR 43.00, the following evaluation should be conducted to determine if a site is a potential productive aquifer (PPA):

(a) All of the following documents shall be reviewed:

1. Department Aquifer Information Overlays
2. USES Hydrologic Atlases-HA
3. USES Surficial Geologic Maps-GQ
4. USES Bedrock Geologic Maps-GQ
5. The Massachusetts 2°
6. The Bedrock Geologic Map of Massachusetts (Ean Zen)
7. Hydrogeologic or geophysical reports addressing local subsurface conditions and or hydrogeology located within the Department's files.

(b) In the event of discrepancies between the data in 310 CMR 43.61(4)(a)1. through 6. and 43.61(4)(a)7. the Department may review the data and make a determination on whether the site overlies a PPA.

(c) Where the site overlies a PPA the Board may proceed to determine if the PPA is qualified for development. In conducting the land use sanitary survey portion of the qualified for development evaluation the site boundary shall be considered the potential wellhead in demonstrating whether existing or historical land uses preclude the use of the aquifer as a public water system. The survey should include the presence or absence of the uses set forth at 310 CMR 22.21(2)(a) and (b), sewer lines and underground or above ground storage tanks. Where the majority of a high or medium yield aquifer is located in a municipality with a population density equal to or greater than 4,400 person per square mile (based on the most recent U.S. Census) the Board may presume the aquifer is not qualified for development. The Board may also install a well and conduct a pump test to confirm that the aquifer is actually capable of a high or medium yield.

(d) In the event that the source is qualified for development, the Board may proceed to determine if the site is located outside of the Zone II or Zone III, as applicable. Sites located within either the Zone II or Zone III of public water supplies that have either received Department approval as a new source or have submitted the appropriate documentation to the Department for a new source approval in accordance with Department guidelines shall be excluded. In the event that the Board desires to install a well to determine the Zone II or Zone III of a future water supply system it should do so in accordance with established Department procedures.

(5) Existing and Potential Private Drinking Water Sources-43.20(1)(d) and (e).

(a) An inventory of existing and potential ground water users should be conducted within a minimum 1½ miles of the waste management area. The inventory should be based on either existing documentation or field surveys or both and should provide information on all of the following: the location, type and amounts of use; the hydrogeologic unit used, typical well construction details and the identity of downgradient users within 1000 feet of the site.

43.61: continued

(b) The Zone of Contribution (ZOC) should be calculated for the existing private wells within a minimum of 500 feet from of the site which are hydraulically connected to hydrogeologic units under the site except where substantial evidence demonstrates that a smaller radius will adequately protect the users. Zone of Contributions are not required to be calculated for private wells beyond 1000 feet from the site except where substantial evidence exists to indicate that a well beyond that point would be adversely affected by a release from the site.

(c) The Zone of Contribution should be calculated by determining the land area which is necessary to receive precipitation in sufficient quantity to meet the reasonsable gallon per day yield of the well.

(6) Water Table Depth and Relation to Bedrock-43.21(1)(g),(h) and 43.21(2)(b).

(a) All significant hydrogeologic units underlying the proposed waste management area should be identified to a depth of 90 feet. The depth to the water table should be estimated by the installation of at least two monitoring wells at appropriate locations (on or off site) which shall be monitored through as many months of seasonal water table fluctuation as feasible consistent with the time limit established by M.G.L. c. 111H, § 20(c) in order for the Board to issue the draft candidate site identification report. Data available from existing regional water table information may also be used.

(b) The depth to bedrock should be determined according to accepted standards, protocols, and principles. Hydraulic conductivities shall be estimated on the basis of lithologic classifications, transmissivity correlations and direct measurement.

(7) Horizontal Gradient-43.20(1)(c). The number of wells to be installed to determine horizonal hydraulic gradient should be based on an evaluation of the complexity of the site, provided that a minimum of one upgradient and two downgradient wells should be used to determine the gradient.

(8) Groundwater Travel Time-43.20(3)(d). In assessing a site's capability to retard migration of contaminants, the travel time of groundwater should be compared to groundwater travel of less than 100 years along a 100-ft flow path from a point of potential release to the edge of the waste management area. The potential adverse effect relative to the projected travel time should be estimated consistent with the likely source term of the waste.

(9) Surface Water Impact Evaluations. In assessing the surface water regime of a site the following parameters should, at a minimum, be preliminarily characterized on a site specific basis and within five miles of the site: the hydrologic system; past, present and projected surface water usage; flood studies; drought studies; precipitation and infiltration; runoff; discharge; channel characteristics; flow velocity; erosion; and sedimentation. In addition, if a sufficient number of site specific samples are obtained or adequate regional data are available, then chemical and physical properties of the waters should be evaluated.

(10) 100 and 500 Year Flood Plains-43.21(1)(c) and (2)(a). When NFIP profile data is unavailable, the extent of this zone should be calculated by methods described in 310 CMR 10.57(2)(a)3. adjusting, as necessary, for the appropriately designed storm event.

(11) Runoff Retention-43.21(1)(f). In assessing the sites the following factors should, at a minimum, be investigated:

(a) The presence and extent of poor runoff characteristics such as depressions, swampy areas, ponded water, or evidence of frequent flooding; and

(b) The extent to which engineered structures are required to protect from ponding or flooding.

(12) Dams-43.21(1)(h)- Sites downstream from dams which were not excluded in the previous report shall be evaluated for potential risk of inundation based upon the probable maximum flood as defined in 302 CMR 10.06. The area subject to inundation should be based on published analysis from the U.S. Army Corps of Engineers or the Dam Safety Division of the Department of Environmental Management. When such analyses are not available, they should be carried out by generally accepted engineering methods.

(13) Surface Water Discharges-43.21(1)(a). Sites with surface water features sustained by groundwater discharges such as perennial and ephemeral streams, springs, seeps, swamps, marshes, and bogs within the potential waste management area should be delineated and screened out.

(14) Distances from Significant Surface Waters-43.21(3)(b). Class A, Class SA and Outstanding Resource Waters as defined and delineated in 314 CMR 4.04 and vernal pool habitats certified by the Division of Fisheries and Wildlife on or near sites should be delineated. The decision on the location and extent of a tributary should be made by reference to the most recent edition of maps generated by the Massachusetts geographic information service based on the United States Geological Survey 1:25,000 scale quadrangle maps unless more accurate maps are adopted by the Department pursuant to notice and public hearing as provided in M.G.L. c. 30A.

(15) Tectonic Processes-43.22(1)(a) and (2). In assessing the geologic regime of a site the following parameters should be investigated on a site specific and regional basis: geomorphology, stratigraphy, lithology, structure, tectonics, seismology and geologic hazards. Geologic hazards include, without limitation, landslides, collapse, liquefaction, significant alteration by surficial processes in last 500-1000 years and other unstable elements in near-surface stratigraphic units and soils.

(16) Slope-43.23(1)(b). The slope should be estimated on the basis of USGS 7.5 minute quadrangles using a scale of 1:24,000 with a contour interval of either ten feet or 20 feet.

(17) Surface Geologic Process-43.23(1)(a). Areas mapped on the USGS maps of Landslides and Related features should be delineated and screened out. The estimation of past rates of occurrence of geologic processes and events may be carried out primarily on the basis of general regional understanding of the evolution of the geologic environment over the past thousand years, in combination with limited site or locality-specific field data for confirmation of important uncertainties. Issues that may require more extensive field investigation may be deferred to the site characterization phase.

(18) Seismic Impact Zone-43.23(3)(c).

(a) Seismic impact zones should be delineated based on a review of the most recent and relevant seismic acceleration maps maintained by Department of the Interior, U.S. Geological Survey and other reasonably available public or private seismic impact investigations that are considered reliable and relevant conducted on locations in Massachusetts or other areas in the Northeast region including, without limitation, sites analysis conducted in relation to the siting of nuclear power plants or radioactive waste storage or disposal facilities. Geotechnical stability may be determined by the use of computer models to approximate the dynamic vertical and horizontal forces caused by bedrock acceleration taking into account local soil conditions. In considering estimating seismic impacts beyond 250 years the Board should consider the source term of the disposed waste and the time period during which its potential release would likely result in dose exposures in excess of DPH performance objectives.

(b) Where sufficient information is available to project the suitable technology which may be located at a site, a preliminary performance assessment of the facility's ability to meet the performance standard of this criterion should be conducted. The performance standard is met if, based on reasonable but conservative assumptions of the estimated useful life of the engineered structures, systems and components important to the safety of suitable facilities and foundation engineering, said engineered barriers are projected to be capable of complying with the standards for earthquake resistance set forth in the State Building Code at 780 CMR 1113.0, *et seq.* In projecting the potential seismic impact the preliminary assessment may consider the applicable NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings.

(19) Contaminant Migration-43.23(2)(a). In evaluating the ability of a site to retard contaminant migration the extent of unconsolidated stratigraphic units that have a high clay or silt content should be determined through published sources, regional boring logs and site specific field investigations.

43.61: continued

(20) Liquefaction Resistance and Soil Stability-43.23(3)(b)(1) and (2). In evaluating the ability of the site to resist liquefaction and provide suitable soil for engineered barriers, site soil samples may be correlated to standards provided in the State Building Code at 780 CMR 1113.0, *et seq*. Available testing may be conducted in accordance with the guidance documents on geotechnical investigation referred to at 310 CMR 43.42(1) if appropriate site specific data is available.

(21) Erosion-43.23(3)(j). General assessment of the erosional process should be accomplished by reviewing published soil maps, evaluating topography, assessing regional geomorphology, evaluating meteorological conditions and assessing local slope conditions.

(22) Dissolution-43.23(3). In evaluating sites, the existence and extent of significant past or present subsurface dissolution areas including, but not limited to, sinkholes, caverns, or underground streams should be investigated.

(23) Demographic Effect on Site Performance-43.24(a). In evaluating the potential for current or changing residential, commercial or industrial patterns in the area that affect a site's performance the following parameters should, at a minimum, be evaluated and considered: current land use, land use and subdivision plans, zoning restrictions, utility land uses, proximity to industrially developed areas and recreational areas that are reasonably likely to experience future growth, agricultural areas and the documented existence of mineral resources at the site. The survey should be conducted within a minimum five mile radius of the site. Estimates on future impacts should be based on time periods coinciding with the expected first year of operating life of the facility through the operation lifetime of the facility.

(24) Proximity to Population Centers-43.24(2)(b). Population size and boundary locations of population places should be defined in accordance with the U.S. Census Bureau published definitions.

(25) Proximity to Residences and Sensitive Population Locations-43.24(b) and (c). The survey should be conducted within a minimum of a one mile radius of the site.

(26) Site Size and Facility Compatibility-43.25.

(a) The candidate sites should be drawn and labelled so as to delineate between the waste management area and that portion of the site to be designated as a buffer zone. There is considerable flexibility in how such a site may be subdivided into distinct zones and utilized, and this process can affect the suitability of the site. For the purpose of characterization the site should include the estimated waste management area and the buffer zone. The designations chosen during this phase of site identification should not be regarded as final or irrevocable, but should be intended to make best use of a site in terms of satisfying the siting requirements.

(b) In assessing the compatibility of the site with suitable facilities the following parameters should, at a minimum, be based upon:

1. SCS soil classification maps,
2. surficial and bedrock geology maps and topographic maps
3. presence of a well defined (granular) surface layer,
4. the degree of the slope,
5. allowable bearing pressure of foundation soils and clearly defined surface drainage; and, if available, from on-site wells,
6. soil thickness, and water table depth.

(27) Meteorology-43.27. In evaluating the frequency, probability and potential consequences for severe weather conditions affecting the site's performance, existing historical records should be reviewed and an on-site environmental monitoring program may be established to obtain preliminary data. The parameters to be analyzed should, at a minimum, include temperature, severe weather incidents such as heavy snowfalls, hurricanes and tornadoes and the annual amount of precipitation. Additional parameters which may be required to establish the site's water budget, facility design loads and airborne release of contaminants may be deferred to the Detailed Site Characterization stage pursuant to 310 CMR 43.71.

(28) Transportation-43.28.

(a) Existing and projected access routes from sites to the point of exit off existing interstate or limited access highways or rail lines should be identified, described and evaluated with respect to:

1. Total travel distance from the site to the point of exit from the highway and/or commercial railway station/siding.

2. The current volume to capacity [V/C] ratio of the access routes(s) and whether the additional projected traffic from the construction or operation of the facility would cause the V/C ratio to exceed 1.0.

3. The current structural status of the access route(s) relative to applicable state and federal transportation laws and regulation governing the transportation of low-level radioactive waste;

4. The need for and the level of effort required to bring the access route into compliance with said law or regulations;

5. The average number of dwellings and public places per mile determined by dividing the total number of occupied permanent residential dwellings and public places on the primary access route by the total distance in route miles from the projected facility entrance to the access point of the interstate or limited access highway or commercial railway station/siding.

6. The yearly average number of serious traffic accidents on the access route(s) in comparison to the statewide yearly average as determined by records maintained by state and local public safety/highway departments.

7. The average number of intersections per mile maintained by local or state highway departments and railroad crossings per mile determined by dividing the total number of said intersection on the primary access route from the projected facility entrance to the access point of the interstate or limited access highway or commercial railway station/siding.

(b) In addition to the field measurement described at 310 CMR 43.61 (28)(a), the Board may assess the level of transportation risk on the basis of the relevant data contained in the NRC guidance document, *The Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 or subsequent updated transportation risk analysis.

(29) Inconsistent Land Uses-43.29(1)(a) and (b).

(a) In assessing the potential adverse effect of inconsistent land uses, the following land uses in existence or having received a permit to construct in effect within six miles of the site from the governing state or federal agency should, at a minimum, be evaluated:

1. Airports. Sites and/or waste management areas within one mile from an airport runway should be delineated and may be screened out considering the size of the aircraft accommodated, frequency of use and flight paths.

2. Operations storing large quantities of flammable liquids. Sites within one half mile from any single aboveground storage tank regularly used for the storage of flammable liquids and having a capacity of at least 500,000 gallons, or from any aboveground storage tank or vessel for liquefied natural gas (LNG) or liquefied petroleum gas (LPG) and having a capacity of at least 25,000 gallons should be delineated and may be screened out;

(b) Measurements of gamma rays emitted by radionuclides in the surface and subsurface soil should be conducted in situ or in the laboratory by generally accepted techniques in assessing the potential of the site to interfere with monitoring.

(30) Protected Lands and Environments-43.31.

(a) Protected resources, lands and species located within a one mile radius of the site should be described and evaluated to determine the nature, extent and likelihood of potential adverse effects from facility construction, operation and maintenance.

(b) All applicable state and federal statutes and regulations that govern the protected resources, lands and species should be reviewed to determine the likelihood that the construction, operation and maintenance of a facility can proceed in light of restrictions or permit requirements contained in said laws or regulations, including, but not limited to, those statutes and regulations listed in Appendix A of 310 CMR 43.00. In evaluating potential adverse effect the following factors may be relevant:

43.61: continued

1. The type and size of the facility as it relates to disruption and/or permanent or temporary alteration of the original conditions of the area that contains the protected resource, lands or species from construction and operation;
2. The abundance and characteristics of potentially affected species, lands and resources;
3. The importance of the protected species, land or resources relative to its commercial or recreational value, including but not limited to, its status as threatened or endangered;
4. The importance of the protected resource, land or species to other protected resources, lands or species;
5. The importance of the protected resource, land or species to the structure and functioning of the ecological system;
6. The importance of the protected resource, land or species as a biological indicator of radiological and non-radiological constituents in the environment;
7. Seasonal and migratory patterns of species within the area; and
8. Existing natural and human induced effects such as farming, logging or recreational uses.

43.62: Quality Assurance Requirements

(1) In addition to the general requirements set forth at 310 CMR 43.43, the Candidate Site Identification Report should be prepared in accordance with the following quality assurance requirements:

(a) The quality assurance program should specify the structure of the organization performing the work, the division of responsibilities, and the location of project personnel within the organization. Persons responsible for the implementation or oversight of the quality assurance program and for technical oversight, review and approval should also be indicated on the organization chart.

(b) The quality assurance program should include procedures to ensure quality in both the data acquisition and analysis program (*e.g.*, sampling and testing methods, equipment calibration, sample custody, verification and validation of models) and information management (*e.g.*, data management, tracking of changes, protection against transcription error). In general, procedures should be included for every phase of work whose output has the potential to affect the results of the investigations or the conclusions to be drawn from the investigations.

(c) The quality assurance program should provide for independent technical review, verification, and approval by persons not directly involved in the performance of the work.

(d) The quality assurance program should provide for the ability to trace and audit all calculations, analyses, deductions, inferences, and project data.

(e) The quality assurance program should provide for internal reviews and audits to verify that the program is functioning according to the written description.

(f) The quality assurance program should provide a method for initiating corrective actions and verifying that they have been implemented.

(g) The quality assurance requirements of 310 CMR 41.63 should apply to all data and analyses used in the Candidate Site Identification Report, irrespective of whether such data and analysis have been previously applied or accepted in connection with the Statewide Mapping and Screening Report or the Report Identifying Possible Locations.

(43.63 through 43.69: Reserved)

43.70: Application Guidelines and Procedures for Use in Preparation of the Detailed Site Characterization Report

(1) Objective. The objective of a Detailed Site Characterization Report is to provide a definitive evaluation of the merits of a candidate site with respect to the requirements for a technically superior site, as defined in 310 CMR 43.10, and to provide such additional site data as may be required for any and all of the following: design of the facility, evaluation of the facility with respect to the performance objectives of the Department of Public Health, and provision of baseline environmental data for subsequent comparisons with monitoring data, and use for related purposes. The Site Characterization Report will be developed in response to a detailed site characterization plan as specified in M.G.L. c. 111H, § 23. The purpose of 310 CMR 43.70 is to provide guidance on how the requirements for a technically superior site are to be applied during this phase of investigation and evaluation.

(2) Data Collection and Evaluation Protocols.

(a) The Report should be prepared in compliance with the provision of 310 CMR 43.42 regarding conformity with relevant Nuclear Regulatory Commission and Department of Energy guidance documents governing the characterization of low-level radioactive waste sites and the site-related issues of the facility. Nothing herein should prevent the Board from conducting further investigations and assessments as a result of the plan developed in accordance with M.G.L. c. 111H, § 20.

(b) The Report should be prepared in compliance with the provisions of 310 CMR 43.60(2) except to the extent that said provisions are limited to the preliminary aspect of the prior stage of data collection and analysis. Preliminary evaluations which were commenced in connection with prior stages should be expanded in scope and level of detail and accuracy, as necessary to comply with the regulations herein, and completed.

(c) The Board may adopt a reasonable but conservative sensitivity factor in conducting performance assessments of the candidate sites for the purpose of determining whether a candidate site can meet the DPH performance objectives and for comparing the relative performance of candidate sites.

43.71: Specific Guidance for the Application of Particular Conditions

(1) Potential Productive Aquifers-43.20(1)(c). Sites located over potential productive aquifers should be eliminated unless the Department has determined that the potential source is not qualified for development.

(2) Existing and Potential Private Drinking Water Sources-43.20(1)(d) and (e). Based on a complete characterization of the site and the surrounding existing and potential water uses, Zones of Contribution studies should be conducted on private drinking water sources with a reasonable potential to be adversely affected by the siting of a low-level radioactive waste facility.

(3) Water Table Depth-43.20(2)(gb. Final determination on depth to the water table should be based on a minimum of a full year of quarterly sampling data.

(4) Minimizing Violations of Water Quality Standards 43.21(3)(a). Compliance with this criterion will be determined based on the results of the analytical and numerical hydraulic and hydrologic modeling of surface water of surface water flow and transport.

(5) Transportation-43.28. In addition to the analysis previously conducted to assess the potential transportation risk, the Board may use a computer-based transportation risk analysis. The analysis should consider reliance on the risk-based guidelines for selecting preferred highway routes set forth in the Code of Federal Regulations at 49 CFR 177.825.

(6) Air Quality 43.30. The potential adverse effects from construction shall be evaluated in accordance with 310 CMR 7.00. The potential impacts from operation of the facility should be evaluated as part of the performance assessment conducted in accordance with 310 CMR 43.00.

43.72: Quality Assurance Requirements

The quality assurance requirements for the development of a Site Characterization Report are the same as the requirements applicable to the development of the Candidate Site Identification Report, as set forth at 310 CMR 43.63.

REGULATORY AUTHORITY

310 CMR 43.00: M.G.L. c. 111H, § 14.

APPENDIX A

(1) MONUMENTS, HISTORIC SITES and CONSERVATION AREAS.
(a) NATIONAL AND INTERNATIONAL MONUMENTS AND MEMORIALS, 16 USC §431, and all applicable regulations.
(b) HISTORIC SITES ACT, 16 USC § 461, including, but not limited to, regulations at 36 CFR Parts 61, 1205, 1212; § 470h-2.(b) *et. seq.*
(c) NATIONAL HISTORIC PRESERVATION ACT, 16 USC § 470, including, but not limited to, regulations at 36 CFR Ch.I § 60.00 *et. seq.*
(d) ARCHAEOLOGICAL RESOURCE PROTECTION ACT, 16 USC § 470aa, including, but not limited to, regulations at 43 CFR Subtitle A § 7.1 et.seq. Uniform Regulations and 36 CFR Ch. II Part 296 *et. seq.*
(e) THE ANTIQUITIES ACT, 16 USC § 432-33, including, but not limited to, regulations at 25 CFR 261.
(f) CEMETERY ACT, M.G.L. c. 114, § 17 and M.G.L. c. 79, § 79, including, but not limited to, regulations at 950 CMR 71.05.
(g) MASSACHUSETTS ENVIRONMENTAL POLICY ACT (MEPA), M.G.L. c. 30, §§ 61 and 62, and any applicable regulations.
(h) HISTORIC DISTRICTS ACT, M.G.L. c. 40C, and any applicable regulations.
(i) STATE HIGHWAYS ACT, M.G.L. c. 81 § 7M, and any applicable regulations..
(j) GENERAL PROVISIONS RELATIVE TO REAL PROPERTY, M.G.L. c. 184, §§ 31 and 32, and any applicable regulations.
(k) MASSACHUSETTS HISTORICAL COMMISSION ACT, M.G.L. c. 9 §§26 through 28, including, but not limited to, regulations at 950 CMR 71.00 *et. seq.*
(l) WATERWAYS ACT, M.G.L. c. 91, § 63 and M.G.L. c. 6, § 179 *et. seq.*, including, but not limited to, applicable regulations at 312 CMR 2.00 *et. seq.*

(2) NATIONAL PARKS; WILDERNESS
(a) NATIONAL FORESTS, 16 USC § 471; MULTIPLE USE SUSTAINED YIELD ACT (National Forests), 16 USC §§ 528-531; and FOREST AND RANGELAND RENEWABLE RESOURCES PLANNING ACT, 16 USC § 1600, and 84 USC § 31, and any applicable regulations.
(b) NATIONAL WILDERNESS PRESERVATION SYSTEM ACT, 16 USC § 1131, including, but not limited to, regulations at 36 CFR Part 251 (Land uses), 36 CFR Part 293 (Wilderness/Primitive Areas), 43 CFR Part 19, 50 CFR Part 35 (Wilderness Preservation).
(c) NATIONAL TRAILS SYSTEM ACT, 16 USC §§ 1241 *et. seq.* and M.G.L. c. 132A, § 12, and any applicable regulations.
(d) HISTORIC PARKS, 16 USC § 410 *et. seq.*, and any applicable regulations..
(e) STATE RECREATION AREAS, M.G.L. c. 132A, §§ 11A *et. seq.* and M.G.L. c. 184, § 31, and any applicable regulations.
(f) PUBLIC PARKS ACT, M.G.L. c. 45, § 7, and any applicable regulations
(g) FORESTRY ACT, M.G.L. c. 132, and any applicable regulations.
(h) STATE RECREATION AREAS, M.G.L. c. 132A, §§ 2A, 2B, and any applicable regulations.
(i) PLAYGROUNDS ACT, M.G.L. c. 45, §§ 14 *et. seq.*, and any applicable regulations.
(j) SHADE TREE ACT, M.G.L. c. 87, and any applicable regulations.
(k) PROTECTION OF WATERSHED RESOURCES AND PRESERVATION OF NATURAL SCENERY IN THE BERKSHIRE MOUNTAINS, M.G.L. c. 131, § 39A, and any applicable regulations.

(l) MONUMENTS AND MARKS, M.G.L. c. 41, §§ 79, 81C, 81D, and any applicable regulations.
(m) EMINENT DOMAIN ACT, M.G.L. c. 79 *et. seq.*, and any applicable regulations.
(n) DESIGNATION OF SCENIC ROADS, M.G.L. c. 40, § 15C, and any applicable regulations.

(3) ENDANGERED SPECIES, PROTECTION OF FISH AND WILDLIFE.
(a) FISH AND WILDLIFE COORDINATION ACT, 16 USC § 661-666C, and any applicable regulations.
(b) BALD AND GOLDEN EAGLE PROTECTION ACT, 16 USC § 668-668(d), and any applicable regulations.
(c) ENDANGERED SPECIES OF FISH AND WILDLIFE (including Migratory Birds), 16 USC § 668dd *et. seq.*; M.G.L. c. 131 §§ 74 through 76, and any applicable regulations.
(d) ENDANGERED SPECIES ACT, 16 USC § 1531-43, including, but not limited to, regulations at: 50 CFR Part 17 (endangered and threatened wildlife and plants); 50 CFR Part 23 (endangered species convention); 50 CFR Part 81, 50 CFR Part 225 (conservation of endangered and threatened species of fish, wildlife, and plants -- cooperation with the states); 50 CFR Part 424 (listing endangered and threatened species and designating critical habitat), and M.G.L. c. 131A, §§ 1 through 6.
(e) NATIONAL ESTUARY PROGRAM, 33 USC §§ 1330 *et. seq.*, and any applicable regulations.
(f) FISH AND GAME LAW, M.G.L. c. 131, § 1 *et. seq.*, and any applicable regulations.
(g) WILDLIFE SANCTUARIES, M.G.L. c. 131, §§ 7 through 10, including, but not limited to, regulations at 321 CMR 7.01.
(h) PROTECTION OF INLAND WETLANDS, M.G.L. c. 131, § 40A, and any applicable regulations.
(i) DIVISION OF FISHERIES AND WILDLIFE, M.G.L. c. 21, §7 *et. seq.*, including, but not limited to, regulations at 321 CMR 2.01 *et. seq.*

(4) WILD AND SCENIC RIVERS, LAKES.
(a) WILD AND SCENIC RIVERS ACT, 16 USC § 1271, and any applicable regulations.
(b) COASTAL ZONE MANAGEMENT ACT, 16 USC § 1451, and any applicable regulations.
(c) EXECUTIVE ORDER 11990, PROTECTION OF WETLANDS, 42 USC § 4321, and any applicable regulations.
(d) CAPE COD NATIONAL SEASHORE PROTECTION, 16 USC § 459b, and any applicable regulations.
(e) COASTAL WETLANDS PROTECTION, M.G.L. c. 130, § 105, including, but not limited to, regulations at 310 CMR 10.01 *et. seq.*
(f) STATE RECREATION AREAS, M.G.L. c. 132A, including, but not limited to, regulations at 302 CMR 5.00 *et. seq.*
(g) WETLANDS PROTECTION ACT, M.G.L. c. 131, § 40 *et. seq.*, including, but not limited to, regulations at 310 CMR 10.00.
(h) SCENIC & RECREATIONAL RIVERS, M.G.L. c. 21, § 17B, and any applicable regulations.
(i) WATER AND WATERWAYS, M.G.L. c. 91, §§1 through 59, and any applicable regulations.
(j) WATER MANAGEMENT ACT, M.G.L. c. 21G, and any applicable regulations.
(k) MASSACHUSETTS CLEAN LAKES AND GREAT POND PROGRAM, M.G.L. c. 21, § 30A, and any applicable regulations.
(l) LOWLANDS AND SWAMPS, M.G.L. c. 252, § 1 *et. seq.*, and any applicable regulations.

Appendix B

Quality Assurance Forms

Draft 1/96

Procedures Tracking Form

Exclusion Criterion: _____

Database Acquisition:

Name	# Tiles	Date Received	Complete

Selection of Exclusion Areas:

Selection	Date	# Polys of X	# Tiles	Initials

Processing (if applicable):

Type	Date	Initials

Final AML

AML Name: _____ Date: _____ Prepared By: _____

Reviewed By: _____ **Date:** _____

Procedure Control Form

Exclusion Criterion: _____ Final Coverage Name: _____

Date: _____ Work Performed By: _____

Coverage Name: _____

Source: _____

Problems Noted: _____

_____

_____

_____

_____

_____

_____

_____

_____

How Corrected: _____

_____

_____

_____

_____

_____

_____

_____

_____

Corrected By: _____ Date: _____

Reviewed By: _____ Date: _____